

Swine Management is a part of the
AGRICULTURAL MANAGEMENT SERIES
prepared under the general supervision of R. W. GREGORY

SWINE MANAGEMENT

including

Feeding and Breeding

SECOND EDITION

ARTHUR L. ANDERSON, *Professor of
Animal Husbandry, Iowa State Col-
lege* -- Edited by R. W. GREGORY

MLSU - CENTRAL LIBRARY



9628EX

J. B. Lippincott Company

CHICAGO -- PHILADELPHIA -- NEW YORK

COPYRIGHT © 1957 BY J. B. LIPPINCOTT COMPANY

COPYRIGHT 1950 BY J. B. LIPPINCOTT COMPANY

LIBRARY OF CONGRESS CATALOG CARD NUMBER: 57-6383

KZ334:6

J7

44

9628

RAJASTHAN UNIVERSITY
EXTENSION LIBRARY
UDAIPUR

Printed in the United States of America

Preface

IN THIS TEXT we have endeavored to cover in a simple and concise manner the available information pertaining to swine husbandry and make it usable to the student. Needless to say, there is much material upon the subject. Only that which has been fairly well established by experiment and experience is included herein. Theoretical aspects have in general not been included. There still is much which has not been definitely proven. In spite of the fact that swine husbandry has been broadly investigated, further research is needed to explain many features of swine production and to point to better means and methods.

The author is indebted to the many who have liberally provided material used in *Swine Management*. An attempt was made to give proper credit to all sources for material used. The author wishes to express his gratitude to all, particularly those not specifically mentioned for the numerous assistances which were generously given.

Most of the illustrations and much of the factual information are from the Iowa Agricultural Experiment Station, the Extension Service, and the Animal Husbandry Department of the Iowa State College. Stenographic help was supplied by the Iowa State College. Co-workers have liberally supplied materials, suggestions, and criticisms which have been of inestimable value. Especial thanks are due instructors and investigators from elsewhere who have been extremely helpful. Practical hog raisers, meat packers, manufacturers of equipment, feeds, and other

products used by hog producers, have supplied materials. To all these the author acknowledges his indebtedness.

The Second Edition of *Swine Management* brings the subject matter up to date. The author is most appreciative to those who have made helpful criticisms of the first edition. Further, the author is greatly indebted to the many individuals and organizations who generously supplied the information and materials for the revision.

Contents

Chapter 1:	THE SWINE-RAISING INDUSTRY	3
Chapter 2:	METHODS OF HOG RAISING AND FARMING METHODS	15
Chapter 3:	JUDGING MARKET HOGS	26
Chapter 4:	SWINE BREEDS	44
Chapter 5:	BREEDING STOCK SELECTION	95
Chapter 6:	THE BREEDING SEASON	110
Chapter 7:	THE BREEDING HERD, FEEDING AND MANAGE- MENT	126
Chapter 8:	THE FARROWING AND SUCKLING PERIOD	147
Chapter 9:	RAISING PIGS ON DRY-LOT	190
Chapter 10:	RAISING PIGS ON PASTURE	220
Chapter 11:	CEREAL GRAINS AND OTHER BASAL FEED	233
Chapter 12:	THE PROTEIN SUPPLEMENTS, ALFALFA MEAL, AND SIMILAR FEEDS	260
Chapter 13:	MINERAL AND VITAMIN SUPPLEMENTS	303
Chapter 14:	PASTURE AND FORAGE CROPS FOR SWINE	316
Chapter 15:	HARVESTING CROPS WITH HOGS	328
Chapter 16:	SWINE BREEDING	336
Chapter 17:	SWINE SHOWS AND SALES	359

Chapter 18: SWINE HOUSING AND EQUIPMENT	373
Chapter 19: MARKETING HOGS	430
Chapter 20: OPERATING THE SWINE ENTERPRISE	452
Chapter 21: SLAUGHTERING HOGS	470
Chapter 22: THE CONTROL OF DISEASES AND PARASITES	487
APPENDIX	509
INDEX	519

**SWINE
MANAGEMENT**

CHAPTER 1

The Swine-Raising Industry

THE UNITED States is the leading hog-raising country of the world. We are generally the first-ranking country in the exportation of pork and pork products. The United States ranks above all of the other countries with the possible exception of China in total number of hogs. As our human population is much less than that of China, we have greater amounts of pork and pork products on a per person basis.

Hogs brought to this continent and the United States. Columbus, on his second voyage in 1493, brought hogs as well as other domestic animals from the Canary Islands to Haiti. Early Spanish explorers brought hogs to Mexico. Fernando de Soto in May, 1539 landed on the coast of Florida. The 13 head of hogs brought by that expedition developed into a large herd, the first in the continental United States.

Growth of hog raising in United States. As the colonists settled this continent, hogs were brought with them to supply meat for food. Settlers along the Atlantic Coast as well as those in Nova Scotia and Newfoundland included hogs in their possessions. Early settlers raised hogs for their own use. As towns developed, a demand for pork was created by those who preferred to buy pork rather than raise hogs.

The Connecticut River Valley developed into a center of hog production. As production exceeded our needs, pork and lard became available for export. Pork was available for supplying meat on ships leaving our shores. The first trade was the ex-



A high school class from Iowa Falls, Iowa, watches a demonstration in hog raising methods.

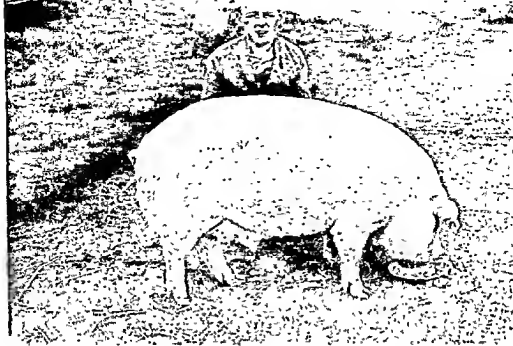
change for sugar and rum with the West Indies. As early as 1790, six million pounds of pork and lard were exported.

With the settling of the West, hog raising moved westward. The Midwest grew rapidly as a hog-growing area. A ready and profitable market for corn was found through hogs and also cattle. Packing plants grew in this area and Cincinnati developed into a large pork-packing center. Packing plants were established at the terminal points of many railroads. These places became known as the central markets. Later with decentralization of the hog slaughter, the interior packers and markets were established. It was not until 1860 that livestock was transported to the markets by railroad. Prior to that time hogs and other livestock were driven to the market.

It was recorded in 1849 that hogs were driven from north Ohio to Albany, New York. From there they were transported by train to Brighton, Massachusetts, one of the oldest livestock markets in this country. Driven hogs would move from 12 to 15 miles per day. Some drives were driven for 50 days.

Pork packing when first started was done during the winter season as it was done without refrigeration. The use of ice, beginning in 1857, made summer slaughter and packing possible. Refrigerated railroad cars were first designed about 1875, and about 1890 mechanical refrigeration came into use.

Areas of hog raising. Swine raising in the United States is centered about the corn-producing area. At the time of the first

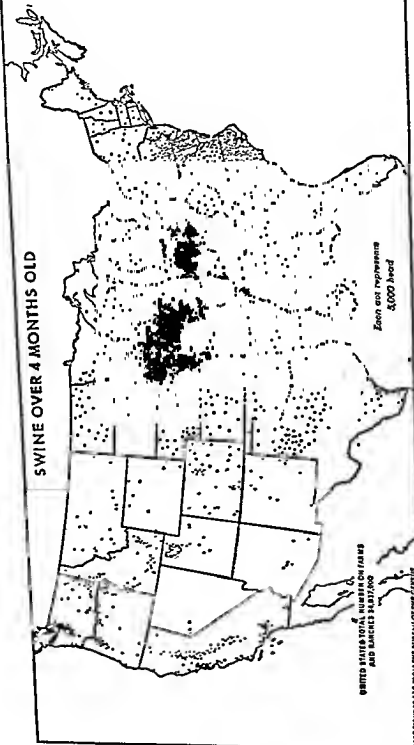


Here is a 4-H Pig Club prize-winning barrow. Pig projects are popular with 4-H club members in swine-growing areas.

U. S. census in 1840, the large hog-growing areas were in the corn-producing sections of Tennessee, Kentucky, and Ohio. The growth since that time has been in the great corn-producing area of the Midwest known as the corn belt. Hog raising has followed corn raising. The concentration of hogs in the corn belt is due, in part, to the quantity of this crop which is available and economical to use for pork production. The abundance of other feeds and forage crops suitable for hog raising also contributes to the superiority of this region in hog growing. Other sections of the United States are suited for raising hogs; in fact, where concentrated feeds, such as small grains and forage crops, are produced there is a place for the hog on the farm. The farmer outside of the corn belt may find that his feed costs are relatively higher, but he may be nearer a higher market. In the range area, hog production is unimportant as sheep and cattle are more adapted to use the available feed. A farmer can economically produce his home supply of pork. See page 6, "Distribution of Swine in the United States."

More than one-half of the corn grain raised in the commercial corn-growing states is fed to hogs. This accounts for the fact that

SWINE OVER 4 MONTHS OLD



Each dot represents
5,000 head

UNITED STATES TOTAL NUMBER ON FARMS
AND RANCHES 24,317,000

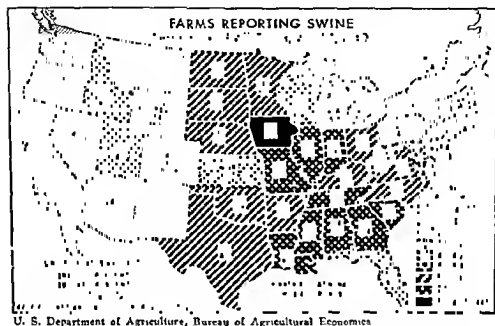
BASE POINTS ARE FROM THE BUREAU OF THE CENSUS

U. S. Department of Agriculture, Bureau of Agricultural Economics

The distribution of swine in the United States follows closely the pattern of the distribution of corn, as corn is the principal feed for hogs. In the states partly or wholly included in the warm fertile corn belt, where corn is abundant and where alfalfa grows well, are concentrated about 60 per cent of all hogs. There are at least six times as many swine per square mile in the corn belt proper as in the cotton belt.

the corn belt is the main source of our commercial supply of pork and lard. See page 6.

Hog production is carried on successfully in other areas of the United States. The feeds differ in the various sections. On the basis of hog population, the breakdown is about as follows:



These farms report swine production figures. In the corn belt there is the largest proportion of farms raising hogs.

corn belt, 60 per cent; the South, 20 per cent; the Atlantic Coast region, 13 per cent; and the western states, 5 per cent.

Farms and ranches raising hogs. The last agricultural census indicated that hogs were raised on 62 per cent of the farms and ranches of the United States. The North Central states have the largest proportion of farms raising hogs (70 per cent). In Iowa hogs are raised on 85 per cent of the farms. Hogs are widely distributed in farming areas but are sparse in the range and New England areas. In the Pacific division, hogs are raised on less than 20 per cent of the farms.

Hogs on farms in United States. An estimate of the numbers of hogs on farms is made as of January 1 of each year. Following

the Civil War, hog production was expanded. The number vary markedly from year to year but until 1923 the tendency was upward. There followed an irregular period with a low point in 1935 which was after the depression and a severe drought. Numbers then raised until the all-time high peak of 1944 during World War II. The range in hog numbers has been very marked. The range in recent times has been from a low of 39 million in 1935 to a high of nearly 84 million in 1944. Since 1944 numbers have shown a downward tendency with some irregularity from year to year. See page 513, Table 70.

Farm income. The cash receipts from farm marketings in the United States reported for a recent ten-year period follows:

	BILLIONS OF DOLLARS
Hogs.....	3.2
Cattle and calves....	4.6
Dairy products.....	3.7
All livestock and products..	15.1
Crops sold or traded.....	11.6
<i>Total livestock and crops.....</i>	<i>38.2</i>

The gross income from farm production indicates the relative importance of the income from different commodities. There are about 51½ million farms on which the operator's total income from agriculture for a recent year was \$2,557 per farm and \$655 per capita (living on farms). The cash receipts from hogs were about one-eighth of the total. In cash receipts from the kinds of livestock, hogs rank below cattle and calves and dairy products.

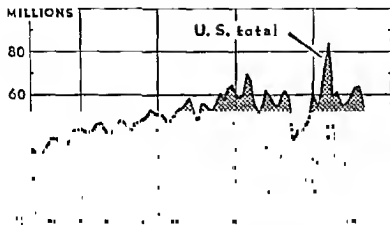
Cash receipts from hogs. The average farm had an income of about \$554 per year from the hog crop for a recent ten-year period. Hogs rank high as a source of farm income. Cotton, dairy products, cattle and calves, and wheat outrank the hog as a source of cash income to the farmer. In Iowa about two-fifths of the farm income is derived from the sale of hogs.

World distribution of hogs and pork production. Even though the United States is the leading country in hog production, the North American continent has a smaller hog population than Asia and Europe. The world population is about

300 million head, roughly about four times that of the United States. It will be noted from a study of page 10 and Table 67 that the areas of dense hog population are in central and north-western Europe and central United States, southeastern Brazil, and eastern China.

The production of meat is quite closely related to livestock numbers. Countries with larger hog numbers therefore produce

HOGS ON FARMS JAN. 1



DATA FOR 1929 ARE ESTIMATED

U. S. Department of Agriculture, Bureau of Agricultural Economics

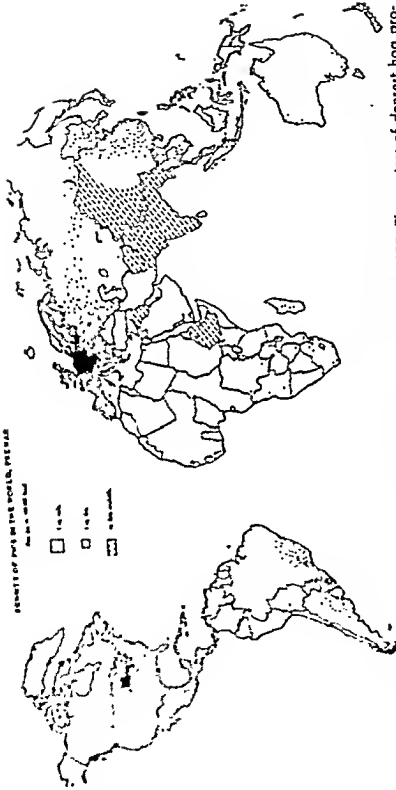
Hogs on farms are variable. The numbers go up and down in response to factors affecting the profitability of production.

larger quantities of pork and lard. China, the United States, Brazil, the U.S.S.R., and West Germany have the largest hog populations. Other outstanding producers are the United Kingdom, Italy, France, Poland, and Denmark.

Hog numbers as related to population. Denmark leads all countries of the world in hog numbers as related to population. For a prewar period in Denmark, there were 83 hogs per 100 inhabitants. Some other countries and their hog population per 100 inhabitants are Brazil, 55; New Zealand, 48; United States, 37; Germany, 37; and Argentina, 29.

As our hog population varies markedly, there is a big variation in the number of hogs per 100 persons. The low year was

CENTERS OF PORK IN THE WORLD, 1925-26
 Each dot = 100,000 hogs



This map shows the number of hogs all over the earth. Each dot represents 100,000. The centers of densest hog production are the corn belts of the United States and Hungary and the potato and dairying belts of northern Europe.

1932 with 31, and the high year was 1888 with 94 hogs per 100 persons. Hog production has increased in efficiency. We now get greater production from our hog population.

Pork and lard consumption. We commonly eat more pork (excluding lard) than beef. Pork makes up about one-half of the meat eaten by the average person. On the basis of the nutrients, pork makes up about 12 per cent of the protein and 7 per cent of the energy (calories) of the food consumed by people in the United States. On a per person basis, pork consumption is about 68 pounds per year. This is about three ounces per person daily. About 156 pounds of red meat is consumed yearly per person.

The average yearly consumption of lard has been about 11 pounds per person per year. This makes up a substantial contribution to the calories or energy we eat.

The large size of the hog-raising business is indicated by the total production and the value of the products. For a recent ten year period there were over 10 billion pounds produced which had a value of over three billion dollars.

Advantages of hog production. There are many advantages of hog raising, a study of which is of assistance in determining the opportunities in this field.

1. Hogs are very efficient converters of concentrated farm feed into meat and meat products.
2. The returns in pork production come quite rapidly. The pigs can be marketed six months after farrowing, or about ten months after the sow is bred. Hog production can be stepped up faster than that of either cattle or sheep.
3. The investment required for equipment and breeding herd is relatively small.
4. The pig is adapted to diversified and intensified farming.
5. Brood sows are prolific and may produce two litters per year.
6. No animal equals the hog in fat-storing ability, and lard, or rendered hog fat, is the most valuable body fat produced by farm animals.
7. Hogs are efficient converters of many by-products into pork and pork products, utilizing those originating on the farm

as well as from the manufacture and processing of human foods.

8. Hogs give an outlet for great quantities of home-grown grains, especially corn.

9. Roughages are used in small quantities, and but a small acreage of pasture is required for growing and fattening hogs.

10. Since hogs are adapted to self-feeding and full-feeding, the amount of labor is rather low.

11. There is but little spread in the price of market hogs. A good price is paid for a wide range of hogs. For example, the market price for old sows is comparatively high. There is much less spread in hog prices than in cattle prices.

12. Periods of low prices, because of over-production, are of short duration. The entire hog price cycle is complete in from three to five years' time.

13. Hogs have a high dressing percentage and are usually in demand as meat animals because of the great consumption of pork products in this country.

14. For supplying farm meats the hog is unexcelled because of the ease in dressing, cutting, curing, and utilization of the carcass.

15. Pork is well suited for curing and smoking. At least 65 per cent of the pork cuts are normally sold as cured products.

16. Forecasts in production and price outlook are available in sufficient time so that one may alter plans to take advantage of favorable price situations.

Disadvantages of hog production. There are also disadvantages in raising hogs. The main objections are:

1. A large percentage of concentrates are used in swine feeds. This may cause a high production cost.

2. Fences of a more expensive kind are necessary for hog raising.

3. Pastures are spoiled for other classes of livestock when grazed by hogs.

4. Control of diseases and parasites requires much time and labor.

5. Hog prices vary, necessitating a study of prices in order to determine when and where to sell.



These are purebred Hampshire gilts on pasture. Intermediate type gilts such as these produce pigs profitable to the hog raiser and pork packer.

6. Hogs are not suited to holding for a better market when finished.

7. The labor required at farrowing time is great. Attention, skill, and proper management at farrowing time are imperative for a good production record.

8. Pigs, to be successfully raised, should not be confined to a small soil area on the farm, although this tends to reduce labor and housing costs. Confinement feeding requires concrete lots.

Pork is produced economically. Farm animals are grown because they transform feed into human foods of high quality which carry special nutritive properties. Consumers show a preference for food of animal origin. Meat is rich in many of the nutrients needed by the body for strength and growth. When feeds are used for livestock there is a loss of nutritive material. Swine, however, rank high in the production of pork and lard from feeds. About 20 per cent of the energy and 15 per cent of the protein consumed by swine is recovered in the products produced. Hogs are efficient converters of concentrate feeds, like grains, into human food. They will produce more food per bushel of grain consumed than any other animal.

Why is the pig efficient? The pig has superiority over other farm animals in the proportion of digestible food energy that is

stored. The capacity to consume great quantities of feed gives a large surplus of food energy which is available for body storage. Also the pig is quite adept in adjusting himself to environmental conditions.

SUGGESTIONS FOR FURTHER STUDY

1. Make a study of data in the U. S. Department of Agriculture Yearbook, *Agricultural Statistics*, for the current year to determine the standing of various countries in hog numbers.
2. From the same source used in number 1, make a study of the hog population in various states.
3. Determine the leading hog-raising counties in your state.
4. Make a study of a farm in your locality to determine the advantages and disadvantages of hog raising.
5. Make a survey of farms in your locality to determine why farmers in your section raise hogs.
6. What are the advantages and disadvantages of raising hogs in your locality?

REFERENCES

- CARROLL, W. E. and KRIDER, J. L. *Swine Production*. The McGraw-Hill Book Co., New York
- ENSMINGER, M. E. *Swine Husbandry*. The Interstate Printers and Publishers, Danville, Illinois
- McMILLEN, W. N. *Hog Profits for Farmers*. Windsor Press, Chicago
- SMITH, WILLIAM W. *Pork Production*, 3rd Ed. The Macmillan Co., New York
- United States Department of Agriculture:
Swine Production. Farmers' Bulletin
Agricultural Statistics. Yearly
Livestock for Small Farms. Farmers' Bulletin

CHAPTER 2

Methods of Hog Raising and Farming Methods

ON OUR farms hog raising may be a major or a minor enterprise. Hog farming is regarded as being a type of farming, classified in census reports as animal-specialty farms. Type so used is a broad term and refers to the organization and method of operation quite typical on a group of farms. Hog farming then is a type in which hog raising is a major enterprise. In certain sections in this country, conditions such as crops produced, soil, markets, climate, and other factors are favorable to hog raising. Such is the case with the corn belt. On the other hand, we find conditions such as in the range country quite unfavorable for raising hogs.

Since feed is the largest single item in hog-producing costs, hog production is highly dependent upon the amount and kind of feed available. Efficient hog raising involves getting the most out of the feed supply with the labor and managerial ability available.

Farmers are attracted to hog raising because of the profit which may be derived from it as compared with other agricultural enterprises. Productivity of the land, climate, prices, and management are some of the classes of influence which effect the earning capacity of a farm. In considering the operation of a hog farm or the management thereof, the reader will find Chapter 20, "Operating the Swine Enterprise," helpful.

General plan of hog raising. The plan adopted must be suited to the farm and the operator. There are two common



This is the centralized or confinement system of hog raising. The pig crop is raised from birth to market in the farrowing house and adjoining concrete lot.

general plans used in the production of hogs on farms: (1) the centralized system and (2) the decentralized system. Advantages and disadvantages are quite apparent. The first has its most complete expression in raising hogs in confinement, usually on concrete. The second involves the use of portable houses and the raising of the hogs out on the land or pastures.

Systems of hog raising. On hog-raising farms we find that there are many different systems. These are based on the housing employed and the use or nonuse of pasture. There are points in favor of each system. Much depends upon whether the one-litter or the two-or-more-litters a year plan is used. If the latter is to be followed, a central farrowing house for early pigs is probably necessary. On some farms, movable houses are used and drawn together at the farmstead for early farrowing.

Broadly divided there are the (1) central-farrowing system, (2) movable-house system, (3) combination system in which both types of housing are needed, and (4) confinement system in which the hogs are confined to concrete or similar lots combined with suitable housing. In deciding upon a plan, we should

first consider why we keep hogs, the functioning of hogs in farming, and the adaptability of a farm for hog production.

The principal reasons for the keeping of hogs on the farm.

1. By feeding farm feeds, including low-grade and unmarketable feeds, to hogs a home market is provided.
2. When hog raising is a part of the farming operation remunerative employment is provided. Hogs like other livestock provide a profitable use of labor as well as power and equipment during the winter months. Also, a farming operation can be expanded to suit the operator and provide a use for labor available.
3. Hogs assist in maintaining the fertility of the farm.
4. A concentrated product (live hogs) is marketed, preventing market gluts of grain, reducing distribution costs, and selling less fertilizing materials from the farm.
5. Hogs convert waste materials into products for human use.
6. The overhead expenses are spread over a larger volume of business.
7. Some crops such as pasture and corn for hogging down are grown reducing the labor and power needed.

Functions of hogs in the farm business. In many sections of the United States the hog occupies but a minor place in the farm business. By means of the pig, wastes from the kitchen, crops grown, and livestock feeding are converted into a finished animal, capable of being used as a home supply of meat. On the basis of gross agricultural income, the hog is of the greatest importance in Iowa, yielding about two-fifths of the total. In all states the gross income from hogs is a noticeable amount representing, in the aggregate, about one-eighth of our agricultural income.

Factors which influence value of farm for hog raising. The factors related to the effective management of a farm for hog raising follow:

1. *Size of farm.* Inasmuch as the hog on the farm is almost always incidental to the farming operation, the size of the farm has but very little to do with the swine enterprise. If the farm is large, by virtue of much acreage of untillable land, it is, of



This is a brood sow, often referred to as the "mortgage lifter." Hogs are an important source of agricultural income. Hogs efficiently convert feeds into pork and pork products.

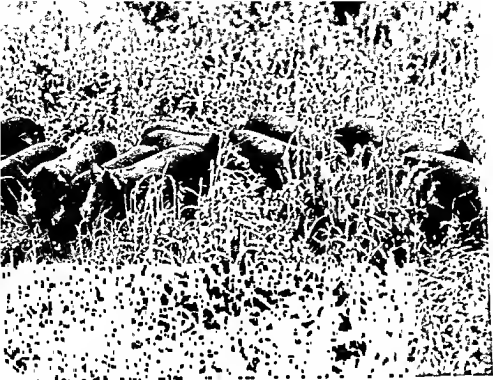
course, suited to cattle raising. There is no definite best size hog farm; 80 acres may suffice. Unless it is planned to purchase additional grain there should be about three to four acres of crop land for each brood sow kept. The possibility of a crop failure or a partial failure should be considered since liquidation of the pig crop because of a short feed supply may be quite disastrous. With a small farm the danger and difficulties encountered from contaminated ground are greater and it is a more perplexing problem to work out a satisfactory plan of pasture rotation. The hog pasture should be included in the regular farm rotation and the entire farm fenced for hogs. Large herds of brood sows are difficult to attend properly at farrowing time. Large farms, capable of handling large numbers of hogs, are often limited because of this reason. One man can manage 30 to 40 sows at farrowing time quite well if ample equipment is provided. Sow herds much larger in size present many difficulties and are not so common. A herd of 15 to 20 sows can be handled nicely by the farm operator along with other farm duties. With a smaller size of farm the operator can give his personal atten-

tion to the enterprise, which is of the greatest importance to grow swine successfully.

2. *Location of the farm.* Most of the hog farms are centered in the corn belt, yet there are numerous hog farms located in all the agricultural regions. The movement of hog raising is due, in part, to corn production and, no doubt, to several other factors. Industry and dense populations attract hog farms in a rather indirect way, the hogs being used in the proximity of large cities as an outlet for certain by-products, such as garbage. High-priced land, as occurs near large cities, is not conducive to hog growing unless that land can economically grow feed usable in pork production.

Advantages of locating in a hog-growing district. The perpetuation of any type of farming, in any district, is quite definite proof of its profitableness. Many advantages are derived from such a location, chief of which, perhaps, is the nearness to established markets for the finished product, or market hogs. In such a section, breeding stock is readily available. When hogs are numerous in a region the danger of losses from diseases is correspondingly greater. The chief diseases affecting hogs are hog cholera, abortion disease, swine erysipelas, necrotic enteritis, influenza, tuberculosis, and trichinosis. Sections in which hogs have been grown for many years require the clean-ground plan of hog raising or a sanitary confinement system for success.

3. *Distance from a market.* The past years have marked a decentralization of the pork-packing industry. New markets have developed and new buying points have been established. The local livestock buyers, in many cases, have joined with an independent buying organization, and some have ceased to function. The partial replacement of the independent local buyer has not reduced the outlets for hogs. We have more markets, either in the form of concentration points, packer buyers, local packing companies, auction-sale barns, or cold-storage locker plants than formerly. The use of the truck in hog marketing has brought the hog man nearer, in time, at least, to his market and has given him a greater range in choice of market. Trucking is well adapted to the marketing of hogs since hogs can be picked up at the farm and delivered to the stock yards



This pig crop is on pasture. Most hog raisers use pastures for raising pigs, especially the spring crop.

or packing plant. This, coupled with good roads, places the farmer, when within the usual trucking distance, a few hours from a market. The eastern markets usually have higher prices than western markets. Costs of production have likewise been higher in the east, in most cases.

With improved methods of live-hog transportation and selling, the matter of distance from market has become of relatively less importance. The farmer now often knows the price he will receive for his hogs before the sale has been consummated, whereas, previously, he shipped his hogs and did not find out what they would bring until they were sold by his representative on the central market.

4. *Productive land.* A hog farm should have a large amount of the land in harvested crops, such as corn; it should be fertile and produce consistently high yields. Lack of acreage in harvested crops would be the limiting factor. Land in ample amount, that is in good condition and of excellent quality, is the main prerequisite in determining the adaptability of the farm for specialized swine raising. Farms with large acreages of

permanent pasture, woodland, and otherwise undesirable features are better suited to cattle raising than to swine growing.

5. *Building and equipment.* The building and equipment phase of swine growing is discussed in Chapter 18. The need for suitable facilities is widely recognized. The barns should be such as would properly house the herd, and the equipment must be adequate for the carrying out of a modern plan of pork production. Central houses and old lots should be eliminated as places to raise the pigs. However, the central house serves well as a farrowing house, and the old lots can be used for the older hogs. In considering the production possibilities of a farm, the condition of the buildings needs to be considered. Central houses often are in need of repairs. Note carefully the condition of the house, as well as its location as regards drainage and convenience. In addition to the swine buildings, the farmer should also consider the other equipment and note its adequacy.

6. *Yards, fields, and fencing.* The ideal would be to have the entire farm fenced "hog-tight" so that all fields could be used, if desired, as fresh, clean hog pasture. Small lots near the central house, with suitable gates and lanes, are also a great convenience, and, if properly used, they may be kept quite free from contamination. The matter of feeding floors and other conveniences should also receive attention in judging the suitability of the farm for hog raising.

7. *Water.* Creeks, rivers, ponds, and lakes are excellent as sources of water, but usually they are not accessible for watering swine. Also, there is the danger of contamination. Hog cholera and other swine diseases have been spread by these carriers, especially by streams. Ample watering facilities should be available. The supply and also the location of the supply, in relation to the probable hog pastures, are essential considerations.

8. *Roads.* It is seldom in this day that hogs are driven to a local market or shipping point. Hauling pays, through greater convenience and less loss in weight, or shrinkage. Good roads, therefore, are a consideration as is the possible condition of the roads at the time of shipping. Market receipts, and consequent prices, are influenced by the condition of the roads. A hog farm is advantageously located where weather conditions have no

appreciable effect upon the roads. A good location on a well-traveled highway is of advertising value to a purebred breeder.

9. *Topography of the land.* Hogs cannot utilize rough land to best advantage. Land that is flat or rolling is very satisfactory for a hog farm because of its high percentage of tillable land. Where rough land is common and permanent pastures prevail, cattle will return more per unit of land than hogs.

10. *Drainage.* Land that is soft because of lack of drainage is not suitable for hog pasture. This is likewise true in hogging-down of crops. If the soil is not properly drained and is soft, the best results from hogging-down corn cannot be obtained. Drainage likewise reduces the wet spots where the hogs will make wallows.

11. *Climate.* Outdoor feeding generally returns the greatest profit to the swine feeder. In sections where climatic conditions permit outdoor feeding most of the year, without discomfort to the hogs, the feed costs are usually lower; less housing space is necessary; and less labor is required. If outdoor feeding is impractical in certain parts of the year, indoor feeding facilities should be provided which require the minimum of labor.

12. *Healthfulness.* A great number of conditions affect the healthfulness of the farm, and if the previously mentioned factors are ideal, in all probability it will be a healthful farm for hogs. Climate, elevation, drainage, location and suitability of buildings, adequacy of other equipment, and lack of nutritional factors in the rations are points to be considered in this all-important matter.

13. *Other features influencing farm selection.* The preceding points are presented from the viewpoint of a farm suitable for swine production. The swine grower, of course, should not minimize the importance of such things as suitability for a home, the cost of the farm, schools, churches, neighbors, and many other points which may alter the value of a farm.

Crop adaption. The corn belt grows most of the hogs of the United States and also most of the corn. This linking is advantageous. Although some corn-belt farms fail in many respects in being ideal in size, location, and other points, they continue as pork producers because of their economic advantage



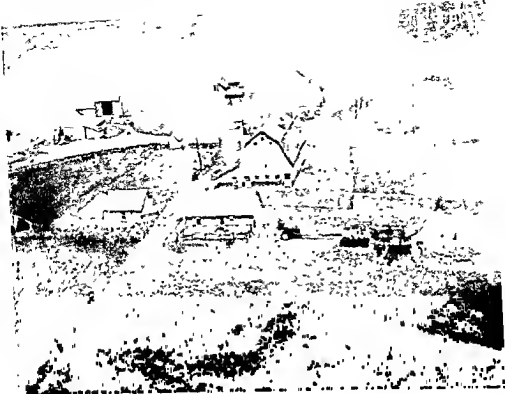
L. N. VanAntwerp Farms, Tulsa, Oklahoma

The modern-type brood sow is an efficient producer. This Chester White saw farrowed 27 pigs that were sired by a Duroc boar. Eighteen of the pigs were raised to maturity.

in this line. In this case the crops are adapted, but greater efficiency would be possible by combining all of the features desired in a hog farm.

In the final analysis, the hog's place on the farm is determined by the profit which can be derived from such an enterprise. In order to have an extensive hog-producing plant we must have an abundance of home-grown feeds which the hogs can consume. Further, accessibility to a good market should be considered. To hold his place, the hog must be an economical outlet for several farm products.

Arranging the hog houses and lots. A good arrangement of the hog houses, lots, and pastures will be a time saver for the farm operator. The following points are to be considered in making the layout of a hog farm or remodeling a farm for hog production.



A model hog farm is pictured here. A. L. Bidne, Lake Mills, Iowa.

1. Grouping of buildings together so that the labor involved can be reduced to a minimum. However, fire safety is to be considered.
2. Feed storage units should be close to the hog houses. Feed handling is to be reduced to a minimum.
3. The buildings are to be easily accessible.
4. Watering facilities should be convenient.
5. The barn and lots are to be located on the farmstead some distance from the home to avoid offensive odors.

SUGGESTIONS FOR FURTHER STUDY

1. Make a field trip to various hog raisers in your community and study the general plan and type of hog raising which they follow. Discuss with them the different features of their hog-raising plans.
2. Outline of plan of hog raising suitable for an average farm in your locality.

3. What are the special advantages or disadvantages of raising hogs in your county?
4. Describe the various systems of hog raising practiced by farmers in your locality.
5. What changes have occurred in recent years in the hogs desired on your markets?

REFERENCES

- CARROLI, W. E. and J. L. KRIDER. *Swine Production*. McGraw-Hill Book Co., New York
- DEYOE, GEORGE P. and J. L. KRIDER. *Raising Swine*. McGraw-Hill Book Co., New York
- SMITH, W. W. *Pork Production*, 3rd Ed. The Macmillan Co., New York

CHAPTER 3

Judging Market Hogs

IN THE raising of hogs, as in the production of any kind of livestock, success in a large measure is dependent upon selection and judging ability. By study and experience this ability can be acquired. The ability to properly select animals is applied to feeding, breeding, and finished or market animals. In this chapter the judging of finished or market hogs will be discussed. This is important because of its relation to the market value. Buyers of livestock are quite adept in estimating the value of a slaughter animal. Producers or sellers need to know how to evaluate animals on foot. Selection or judging of swine for the breeding herd is covered in Chapter 5.

Swine judging like that of other livestock judging is directed toward a practical, profitable, useful kind. We deal in the main with characteristics that have to do with economy of production or carcass value.

Type and purpose. Hog buyers, packers, and swine growers are now more unanimous in their opinions as to the ideal market type of hog than formerly. This ideal should represent perfection or near perfection for the grower, the packer, and the consumer. Much consideration is being given the establishment of this ideal so that the producer may know what will suit the pork packer most of the time. Through exhibits, demonstrations, descriptions, and illustrations, a more unified standard or model has been set up. Judging of the finished hog is the determination of the value of a hog for a certain purpose. In a group

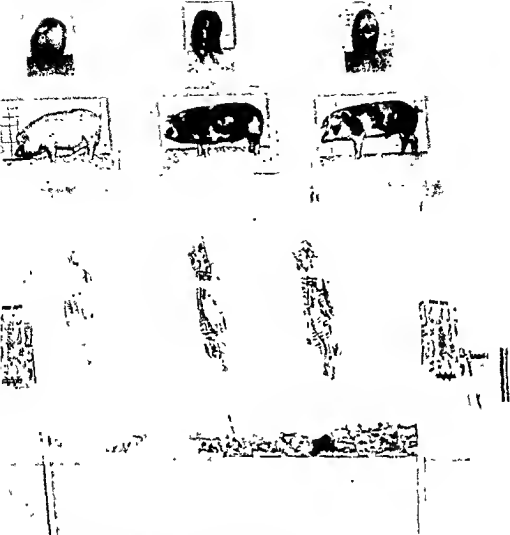


This champion Duroc barrow is at the Notional Barrow Show, Austin, Minn.

or class judging, the individuals of the group are rated in order of their fitness for a definite use. The relation between the characteristics of the live animal on foot and the value of the carcass is the objective in judging slaughter hogs. Proficiency is obtained by experience not only with the hog on foot but also with the hog carcass. The relation between form and performance has long occupied the attention of the livestock improver, and this, coupled with accurate records, has been responsible for the improvement in our meat-, milk-, and work-producing farm animals.

Type in market hogs. The type which is in the greatest demand in this country is the intermediate type of the so-called meat type. Although the bacon-type swine breeds excel in Wiltshire side production, market hogs of these breeds are generally dressed as other butcher hogs in this country. The use to which the carcass is put is dependent mainly upon its weight, form, quality, condition, fat to lean, and in this regard less difference exists between type and breed than formerly.

These illustrations assist in establishing the proper conception of the correct type or correct general appearance.



Wilson and Company, Albert Lea, Minnesota

This picture shows a hog-type demonstration.

Yields from hogs of different types. Within a group of market hogs there may be a range from the small or chuffy to the large or rangy types. These vary in the pork cuts yielded. The table on page 29 shows a typical cutout test from Wilson and Company, Inc., Albert Lea, Minnesota.

It will be noted that the intermediate meat-type hog has the highest yield of lean cuts at the slaughter weights used. Those cuts are the most desired and consequently the highest priced. This illustrates why the meat-type hog is the most desirable from the consumer viewpoint.

TABLE 1. YIELDS FROM HOGS OF DIFFERENT TYPES
Wilson & Co., Inc., Albert Lea, Minn.

	CHUFFY TYPE Hog	INTERMEDIATE TYPE Hog	RANGY TYPE Hog
Live Weight.....	212 $\frac{1}{2}$ £	214 $\frac{1}{2}$ £	218 $\frac{1}{2}$ £
Carcass Length.....	27 $\frac{1}{2}$ "	30"	31"
Shank Length..	3 $\frac{3}{4}$ "	3 $\frac{3}{4}$ "	5 $\frac{1}{4}$ "

YIELD PER CENT OF LIVE WEIGHT

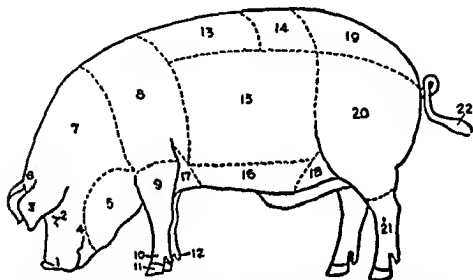
Skinned Ham.....	11.56%	11.57%	12.27%
Loin.....	10.02%	12.50%	11.24%
Belly.....	11.79%	13.43%	10.32%
Picnic.....	5.90%	5.20%	6.25%
Regular Butt.....	4.60%	5.26%	4.93%
Total 5 primal meat cuts.....	43.87%	47.96%	45.01%
Fat Back.....	9.32%	8.41%	6.19%
Clear Plate.....	3.54%	3.62%	2.12%
Jowl.....	2.24%	1.99%	2.29%
Total fat cuts.....	15.10%	14.02%	10.60%

Steps in judging. Judging is the comparison of an individual with a mental picture of an ideal. The first step in judging is to know the standard, or ideal, for the class, age, and kind of animal. Analysis of each animal is necessary in properly placing a class. This is the second step in the judging process. Each is to be compared with the ideal, deficiencies and also good points noted, and after each has been evaluated, a comparison is made between the different ones in the class. This is the third step in judging. After the comparison one comes logically to the final rating or placing, which is the fourth step in judging a class.

Parts of the live hog. On page 30 are shown the location and extent of the parts of the live hog. Judges cannot hope to acquire skill in livestock judging without an accurate knowledge of the name and location of each part. This enables the judge to describe imperfections in conformation and prepares one for the use of the score card.

Score-card judging is not at all common. The greatest value of the score card is for teaching the various parts of the hog and their comparative value, and also the terms used to describe

superiority or inferiority of any part or parts. Two or more market hogs may be scored. The difference between the correct score and the student score is called the "cut." The card can be used for making a rating of two or more on each score-card item rather than allotting a definite number of points; and when



This diagram shows the parts of the hog: 1, snout; 2, eye; 3, ear; 4, cheek; 5, jaw; 6, poll; 7, neck; 8, shoulder; 9, foreleg; 10, postern; 11, toes; 12, dew claw; 13, back; 14, loin; 15, side; 16, belly; 17, foreflank; 18, hind flank; 19, rump; 20, ham; 21, hind leg; and 22, tail.

the class has been rated on the several main points, a final rating can be made which will correspond to the placing of the class. Score-card judging is not applicable to comparative or showing judging because of the time involved in scoring and because a complete balance of points may not be obtained. The judge may score a part higher or lower in studying the one part than in a study of the entire animal as a unit.

Method of procedure in judging. We now have a knowledge of the various parts of a finished market hog, and from the score card we obtain a fairly accurate estimate of the relative values of these points. Scoring should be practiced for the purpose of making a detailed and careful study of single animals. The in-



Here is shown a Paland-China barrow, a grand champion at the National Barrow Show.

dividual pig should be studied from some distance away—about 12 to 25 feet. This inspection should cover not only the side view but also a rear view and front view. Keep in mind the principal points in determining value and systematically satisfy yourself on each of these items. Closer examination follows, those points being noted which are not possible to observe at some distance. Handling is seldom practiced in fat-hog judging and if attempted by an inexperienced judge is very misleading. Care should be practiced in noting all points from different angles, with a decided preference for a view from the distance first. If the judge stands close to the animal being examined, an incorrect estimate of some part or point, especially of symmetry or balance of parts, is quite likely to result.

Judging reasons. If but one animal is being observed, the student should be prepared to give a written or oral description. In a class of two or more, comparative reasons for all placings are in order. Judging-contest competitions in most cases call for ability to rank animals properly and also to give satisfactory reasons for such a ranking. To give a good set of reasons, a student must make careful and accurate observations. A large and

SCORE CARD FOR BARROWS AND GILTS

SCALE OF POINTS

PERFECT
SCORE
POINTS

GENERAL APPEARANCE

1. Weight—according to age 44
6 months 200 225 pounds
2. Form—moderately long, fairly deep, moderately wide; top line slightly arched; underline and sides straight; team middle, balanced, stylish; legs squarely placed
3. Quality—smooth in form and fleshing; free from wrinkles or flabbiness; head and ear medium fine; bone medium size; hair not coarse, bristly, or curly
4. Condition—degree of fatness, indicated by firm covering of flesh over all parts of the body, not excessively fat
5. Dressing percentage or carcass yield—indicated largely by fleshing and trimness of middle

HEAD AND NECK

5

6. Snout and face—medium length, wide, clean cut, not coarse
7. Eyes—wide apart, open, not small
8. Ears—medium size, fine texture, wide apart, well carried
9. Jowl—smooth, neat, and trim, not flabby
10. Neck—medium length, smooth, blending neatly with shoulders and head

FOREQUARTERS

5

11. Shoulders—smooth, even with sides, compact on top, well fleshed, with no depression behind shoulders; chest, wide, deep, full
12. Front legs—medium length, straight, bone medium size, pasterns strong

BODY

30

13. Back and loin—slightly arched, covered with thick, smooth, firm flesh, muscular, fat-back not excessive
14. Sides—moderately long, deep, full, smooth, free from wrinkles; flanks well let down
15. Belly—straight, trim, free from flabbiness

HINDQUARTERS

16

16. Rump—long, wide, slightly arched but not drooping, tail set high
17. Hams—wide, deep, plump, muscular, firm not flabby
18. Hind legs—medium length, straight, bone medium size, pasterns strong

TOTAL

100



Portage Farms

This is a champion Chester White barrow at the Indiana State Fair.

effective vocabulary is essential. Also the presentation should be orderly and convincing.

Using the score card. The score card for a market barrow is divided in five major divisions:

1. General appearance, 44 points
2. Head and neck, 5 points
3. Forequarters, 5 points
4. Body, 30 points
5. Hindquarters, 16 points

These divisions enable judges to divide the job of studying the hog and also, by the points allowed, to emphasize relative values. These main divisions will be discussed separately.

1. General appearance. Weight for age is an all-important point. Fast-gaining hogs are usually the most economical in their gains. To the producer this is often the point that determines profit or loss. The weight, 200-225 pounds at 5 to 6 months, can be expected with full feeding.

Ideas vary concerning form, as do verbal descriptions of form. Packers' wants change, but the description—long, deep, wide,



This is a present-day prize-winning Hampshire barrow of the meat type.

top line slightly arched, underline and sides straight, trim middle—in a great majority of cases fills the bill both as regards profit to the feeder and the needs of the packer. Symmetry is required to have proper balance, no overly-heavy parts yielding cheap cuts, and vice versa. Style and legs set squarely complete the description of the ideal form. Two-hundred and twenty-five pound pigs of the intermediate type, with ample finish will be:

40 to 42 inches long from the base of the tail to a point between the ear along the side

14 to 15 inches deep back of the shoulders

11 to 12 inches wide back of the shoulders

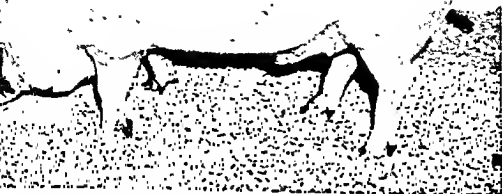
Quality or refinement is shown by smoothness of form and fleshing, with an absence of wrinkles or unevenness in the fleshing or skin. The size of the bone is shown by the shanks, and the head and ear are likewise a clue to the quality. The word "quality" is widely used, very often to infer general goodness. Care should be exercised to confine the term to its proper limits. It is the absence of roughness or general coarseness and the presence of refinement.



This champion Spotted Poland-China barrow is at the International Live-stock Exposition.

Condition or degree of fatness is often excessive in market hogs. To be ideal for the consumer a certain amount of finish or fatness of the animal is essential. Some fat improves the quality of the meat and the cooking properties. Heavy, overfat hogs are discounted because of the large fresh pork cuts. Great width, heavy jowls, lack of trimness along the underline indicate too high condition, which is desired by neither the packer nor the consumer, and is not profitable to the feeder. A firm, muscular covering of flesh over all parts of the body is the ideal situation. Width of body, plumpness of the hams, fullness of the jawl and flanks are indicators of condition. Fatness as indicated by probing the fat-back can be determined on the live animal. About $1\frac{1}{2}$ inches of fat-back is desirable in a 225-pound pig.

Dressing percentage or the percentage of carcass yielded by a hog determines to a large degree its ultimate value, as the carcass is worth more per pound than the offal. Other points being about equal, the greater the fleshing and the trimmer the middle, the higher the dressing percentage. Fat hogs dress higher than leaner hogs, but it must be borne in mind that increased fat yields are not desirable.

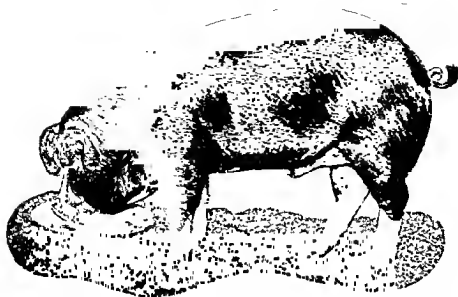


Here is a champion Hereford borrow at the International Livestock Exposition.

2. *Head and neck.* The head and neck are of less importance in number of points than other general score-card divisions. Medium size of head and ear is desirable, and coarseness is decidedly objectionable. The head should not be narrow and long. Eyes that are fairly prominent, clear, and bright are desired. The jowl should be neat and trim. Very heavy, coarse jowls are not wanted, as they produce a cheap pork cut. The neck should be of medium length and size, and should blend well both with the head and the shoulder.

3. *Forequarters.* The forequarters are divided, on the score card, into two parts, *Quality*, and *Quantity*. The *Quality* part of the forequarters is the shoulder. Smoothness is highly desirable. The shoulder blades should be neatly laid in, and there should not be greater width at this point than at other points of the body. A wide, deep chest indicates a strong constitution, as does a fullness or lack of depression just back of the shoulders.

What is said of the front legs may also apply to the hind legs; in addition to being squarely placed, they should show strength as evidenced by the size of bone and strength of pasterns. Coarse,



Wilson and Company

This purebred Poland China barrow was a reserve grand champion at the Cedar Rapids, Iowa, State Spring Barrow Show.

heavy bone is not wanted, but hogs to be adapted to ordinary farm use must have well-developed feet and legs.

4. *Body.* The body, because it is the source of most of the higher priced pork cuts, is considered next in importance to general appearance. A back and loin slightly arched, carrying ample width, and a thick, smooth covering of flesh appeal to hog buyers. Long hogs cut out well in tests because of the long, deep, full sides. These sides, to make high-class bacon, should be free from wrinkles or creases, and should have a high percentage of lean to fat. A straight, trim belly, free from wrinkles, adds to the bacon cut.

5. *Hindquarters.* The ham is the important part of the hind-quarter. The wholesale cut comprises both the rump and the ham, as commonly referred to on the live hog. A long, wide rump continuous with the ideal conformation described for the back and loin and blending into wide, deep, plump hams free from excess fat or flabbiness is desired. Hind legs, properly set, of medium length and medium size, good quality bone, meet the requirement.



Pigs from a prize-winning litter of market pigs are shown at the St. Joseph, Missouri, Interstate Baby Beef and Pig Club Show.

Judging the bacon-type barrow. The fundamental difference is that less finish is demanded in the bacon type and a great degree of leanness required. Hogs of this type should have the lean, lengthy form with some finish. Excessive finish is often called lardiness, and is discriminated against in bacon-hog classes. Hogs of this class dress out a Wiltshire side, a wholesale cut of cured pork from a hog of bacon-type form. The "Wiltshires" are in demand on the English market and are imported from Denmark, Ireland, Canada, and the United States. Such a side is one-half of the carcass minus the head, legs, aitchbone, backbone, and the neck bones. The entire side is given a mild cure and is smoked in one piece.

In Canada the carcasses, rather than live hogs, are commonly sold, and these sales are based upon grade and weight of the carcass. Less emphasis therefore is placed upon the hog on foot or alive. A brief description of the bacon-type pig follows. This covers both the market pigs and those for the breeding herd.

In size the bacon hog should be well developed for its age. The market weight limits are rather narrow: 140 to 170 pounds



This is a champion Tamworth barrow at the International Livestock Exposition.

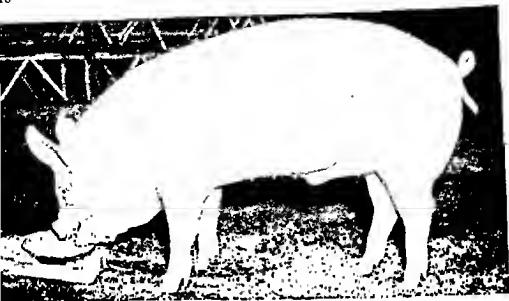
for grade-A class carcasses. Size for age to secure rapid and economical gain and reasonably early maturity are emphasized.

The form of the bacon hog is typical. Briefly, a form that is long and in which all parts are proportionately developed so as to have a well-balanced, strongly built individual is perfection. The top line is slightly arched and carried strong, and the side lines and under lines are straight. Trimness and neatness are essential.

The quality is indicated by fine hair and smooth skin which shows no tendency to wrinkle. Clean strong bone, rather refined, also denotes quality. In individuals of high quality, the flesh is firm and smooth with no flabbiness at the jowl, foreflank, belly, or ham.

In general, bacon hogs have less finish than our common market hogs. A good covering of firm flesh especially along the back and loin is needed, but overfatness is to be avoided.

Canadian score cards for bacon hogs include style, under which they specify that the ideal should be active and sprightly, walking without a swaying movement, and standing well up on the toes. Breeding animals should show strong character.



This Yorkshire barrow was a grand champion at the International Livestock Exposition.

The head will vary a great deal within the breed. Within the Yorkshire breed, which is the predominating bacon breed of Canada, much variation exists. Moderate length and width of head are desired. A face that is broad between the eyes and at the poll is required. Good size, bright eyes, moderately fine ears are specified. A jowl that is of fair width, muscular, neat, and not flabby and a neck that is muscular and of medium length are emphasized.

In the forequarters, the shoulder is the most important single part. It is to be smooth, somewhat rounded from side to side over the top, very compact, no wider than the back, and not extending back on to the side. The breast and chest should be wide, deep, and full.

The body is made up of several very important parts; back and loin of moderate width, rising slightly above a straight line, but not unduly arched, are wanted. Weak, sagging backs are discriminated against. A uniform width and fleshing with a slight arch is the description of the proper back and loin. The side that is deep, long, smooth, well fleshed, and straight between the shoulder and ham meets the requirement of the

Wiltshire. Ribs of good length, moderately arched, are essential for a good side which should be the same width as the shoulders and hams throughout. Fullness at the fore and rear flank is needed for a deep side.

The hindquarter on the usual United States market hog carcass is mainly ham, but on the bacon carcass, it is the gammon, which is further divided into two parts.

On the live hog these are the rump and the ham. A desirable rump is the same width as the back, long and slightly rounded from a point above the hip to the tail, and somewhat rounded from side to side over the top. A ham that is full without flabbiness, somewhat tapering to the back but carrying flesh well down toward the hock, and without wrinkles or folds is desired.

The front and hind legs should be well placed so the individual stands squarely upon them. They should be medium in length, straight, and with pasterns upright. Bone that is clean and strong and feet that are medium size and strongly formed are essential.

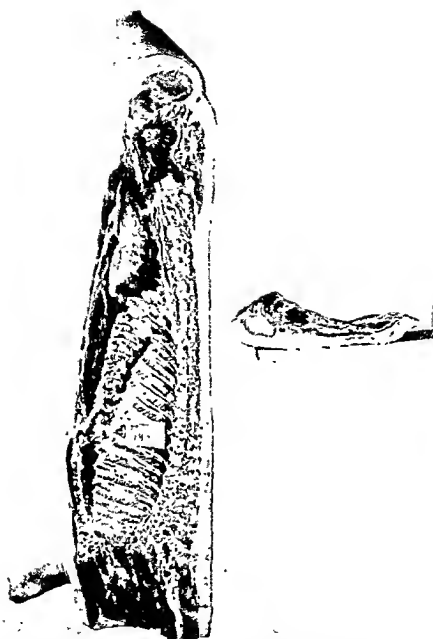
The live hog and the carcass. Since in countries such as Canada and Denmark, which produce bacon for export, the grading is done on the carcass rather than on foot, the appraisal of the market pig on foot is of less importance than it was formerly. Instead of condition of the live hog on foot being estimated, under the carcass grade system, the fat covering can be measured. Note the Wiltshire side on page 42 and the depth of the back fat.

Selection of the breeding individual, however, continues to be a consideration of importance in the production of bacon hogs. Live hog grading has the advantage of setting before the producer the on-foot specifications for a desirable market hog. The characteristics specified will guide him in the selection of breeding hogs.



John Morrell and Company

This photograph shows a judging contest for high school vocational agriculture students. The students are estimating the carcass value of hogs on foot.



Livestock and Poultry Division, Department of Agriculture, Canada

This is a Wiltshire side and a cross section made from the other side of the carcass. The hind leg is cut off at the hock joint before shipment.

SUGGESTIONS FOR FURTHER STUDY

1. Visit a farm and practice judging on market hogs. If possible, follow some of the hogs through the slaughtering process and determine the rating based on carcass value.
2. Arrange to visit the stockyards in your vicinity, and practice judging on some market hogs.
3. Visit a packing plant in your locality, and arrange to have a hog carcass demonstration.
4. Determine from market report the weight and conformation desired in top market hogs at your nearest market.
5. Attend a market hog show in your section of the country.

REFERENCES

- ANDERSON, ARTHUR L. *Introductory Animal Husbandry*. The Macmillan Co., New York
- SMITH, W. W. *Elements of Livestock Judging, Revised*. J. B. Lippincott Company, Chicago
- NORBY, JULIUS E. and W. MALCOLM BEESON. *Livestock Judging Handbook*. The Interstate Printers and Publishers, Danville, Illinois

CHAPTER 4

Swine Breeds

WE HAVE many different swine breeds. These are somewhat distinct groups, having characteristic external features, which are rather uniformly transmitted to the offspring. As breeds grew registration was started and a group of foundation animals accepted. Descendants from these animals became known as purebreds. A purebred then is one that is either registered or eligible to register in the herd book of the breed. The distinctive features of a breed, which distinguishes one breed from another is known as "breed type." There is, however, variation within breeds in type conformation and color.

Early settlers in this country brought in different breeds, mostly from England. Some of these still retain their identity such as the Berkshire, Yorkshire, and Tamworth. Hogs from elsewhere, particularly Spain, were brought to our shores. Also some Chinese hogs were brought to this country via England. These with the British breeds, gave the foundation for most of the breeds created on this continent. More recently the Landrace from Denmark was introduced.

Purebred hogs in the United States. The late census reports have not included numbers of registered purebreds. In the 1930 census 0.6 per cent of the total hogs were registered purebreds. The breeds ranked in the following order in numbers: Poland-China, Duroc, Chester White, Spotted Poland-China, Hampshire, and Berkshire.

In a summary made recently on registrations made in one year, the breeds ranked as follows in numbers of registrations:



Good sows should produce and raise large litters. This is a productive Poland-China sow.

Duroc, Hampshire, Spotted Poland-China, Poland-China, Berkshire, Chester White, Inbred, Tamworth, OIC, Yorkshire, and Hereford.

Prolificacy of breeds. The actual number of pigs a sow farrows is not a reliable measure of the sow's value. The number of pigs raised to weaning time and the weight of the pigs at that time is a good criterion as to the production worth of a brood sow. Many prolificacy studies have been made, and again it should be pointed out that much variation exists within the breed, and also there is a variation between types of swine. In a comparison of studies made by several investigators on the subject of fecundity of the swine breeds from herd book studies, herd records and surveys, the following order of rating breeds as regards prolificacy can be made: Yorkshire, Landrace, Tamworth, Chester White, Duroc, Spotted Poland-China, Hampshire, Berkshire, and Poland-China. Studies from the herd book data from the Poland-China breed show an average prolificacy of slightly less than 8.5 pigs per litter for this breed.

Swine types. Breeds are divided into two groups, on the basis of type, or combination of characteristics which make an animal

highly useful for some specific purpose. The so-called intermediate meat type is the most numerous. At least 95 per cent of market hogs are of this type. Eight breeds of this type are common to this country. They are Poland-China, Duroc, Chester White, Hampshire, Spotted Poland-China, Berkshire, Hereford, and OIC.

Bacon-type hogs are more common in the areas where dairying and small grain growing are the major enterprises. Three breeds of this type are common: the Tamworth, the Yorkshire, and the Landrace.

The difference, in the general conformation or form, between these two types is far less pronounced than formerly. Since heavily fattened hogs have been discriminated against on the market, the breeds have stressed meatiness rather than lardiness. In recognition of the changing demand and its influence upon the lard type, the term "meat" is preferred with reference to type. The meat type is merely one that will have a high carcass value, or meet the demands of the consumer to a high degree. Since there is similarity at the present time between the combination of characteristics of both types, the terms "lard" and "bacon" are less significant than formerly.

Classification of breeds of swine. On the basis of predominating color or color pattern, the common breeds of hogs may be divided into the following classes:

- | | |
|---------------------|---|
| 1. Black | Berkshire, Poland-China |
| 2. Brown or red . . | Duroc, Tamworth, Hereford |
| 3. White . . . | Chester White, OIC, Yorkshire, Landrace |
| 4. Belted . . . | Hampshire |
| 5. Spotted . . . | Spotted Poland-China |

The breeds of a few numbers in the United States, often termed minor breeds, are listed below, with predominating colors:

- | | |
|-------------------------------|-------------|
| 1. Mulefoot | . Black |
| 2. Kentucky Red Berkshire | . Red |
| 3. Cheshire | . White |
| 4. Essex | Black |
| 5. Victoria | White |
| 6. Large Black | Black |
| 7. Sapphire | Bluish coat |
| 8. Small and Middle Yorkshire | White |

A division may be made on the carriage of the ears, in our common breeds:

1. The following usually have erect ears:

Berkshire	Yorkshire
Hampshire	Tamworth

2. The following have drooping ears:

Poland-China	Spotted Poland-China
Duroc	Chester White
Hereford	OIC

KEY TO DETERMINE THE BREED

The following key or chart of differences may be used to distinguish one breed from another.

I. Uncloven or solid hoofs like horse or mule instead of toes; small size; erect ears; black color; uncommon. . . . MULEFOOT

II. Cloven hoofs, two toes like cows.

A. Solid black.

1. Small size; erect ears; small head, ear and bone; uncommon ESSEX

2. Larger size; drooping ears; heavy head, ear and bone; uncommon LARGE BLACK

B. Black predominating, some white.

1. Black with white belt encircling the body including forelegs; erect ears; common HAMPSHIRE

2. Black with white points, usually face, legs, and feet; head and face rather short; erect ears; common
BERKSHIRE

3. Black with white points, usually face, legs, and feet; head and face medium length; common
POLAND-CHINA

C. Black and white spotted about even in amount from 20 to 80 per cent range; drooped ears; common
SPOTTED POLAND-CHINA

D. Red, brown or sandy color.

1. Erect ears; long head and face; lean appearance; common TAMWORTH

2. Erect ears; short head; thick appearance; uncommon
RED BERKSHIRE

3. Ears drooping; face and head medium length; commonDUROC
- E. Red and White; somewhat the same as Hereford cattle; commonHIREFORD
- F. Gray or bluish cast; uncommon.....SAPPHIRE
- G. White.
 1. Ears erect; usually lean in appearance; large size; face usually dished; angular appearance of rump and ham; commonYORKSHIRE
 2. Ears drooped; large size; face usually straight; usually thicker in appearance than Yorkshire; rounded, plump appearance of rump and ham; common.....CHESTER WHITE
 3. Ears erect; medium size; uncommon.....CHESHIRE and VICTORIA

Types within a breed. The word "type" is also used to denote differences in form or general conformation within a breed. A Berkshire may be of the meat type in this country, and of the bacon type in England. A range of type, correlated with size and form, is present in many of the breeds. The intermediate or medium type is common today. The extremely large type has been disregarded, and the very small type, as exemplified by the small, chuffy Poland-China, is not at all common.

The small types were popular in the forepart of this century. An extremely fat, rapid-finishing hog was the ideal of the breeders, and high lard yield and heavy cured cuts were desired by the pork packer. This type proved uneconomical on the farm because of the slow gains and low prolificacy, as well as not being suited for forage crop utilization.

The intermediate type appears to be the best suited for the present-day pork producer, not because of superiority in rate and economy of gain, but because meat from this type suits the requirement of the present-day pork trade.

Then came a demand for extremes in the opposite direction: very large types were the ideal. Slow maturity, lack of finish at a young age (or market weight), excess of bone, and small percentage of highly valuable cuts made the extreme rangy kind unpopular with the packer. The farmers, too, were not reluctant

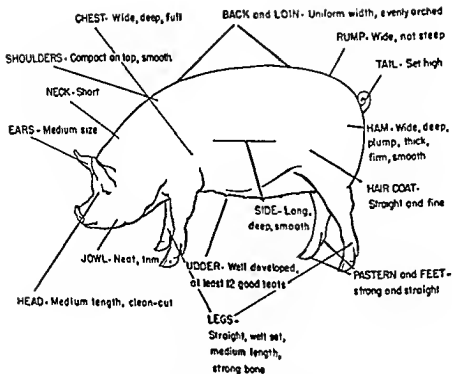


This purebred Hampshire boar pig is being sold at auction at a Hampshire hog sale.

to shift from the extreme big type to the medium-to-big type. Sows of the extreme rangy type, when mature, were too large for usual farm farrowing house equipment and would often raise but small litters. The present-day purebred breeder, in the majority of cases, maintains herds of the intermediate type. In the hands of the raiser of market hogs, the seed stock obtained from the breeder results in the production of medium to large- or intermediate-, type market pigs.

Weight has been the dominating factor in determining the price of market hogs; consequently, but little consideration has been given to the influence of conformation and actual value. More thought is being directed toward this relationship and returns will, in the future, more closely approximate actual value.

Conditions in this country vary, and perhaps the question as to the kind of hog the packer wants cannot ever be given a definite answer. His wants are determined by consumer demands, which are also quite changeable. Intermediate-typed hogs produce carcasses which have higher percentages of valuable cuts; but the demand for pork products is variable. Changes in type, therefore, will continue, because demands influence type; and a



The points of a sow are illustrated here on an immature sow. Scale of points and their relative value: head and face, 4; eyes, 2; ears, 2; neck, 2; jowl, 2; shoulders, 6; chest, 12; back and loin, 14; sides and ribs, 9; belly and flank, 4; horn and rump, 10; feet and legs, 9; tail, 1; coat, 3. All of these points are shown above. Points not shown: color, 2; size, 8; action and style, 3; condition, 2; disposition, 2; symmetry of points, 3; total, 100.

satisfactory kind of hog for the farmer is but one part of the story.

That the intermediate type is generally superior is indicated by the U.S.D.A. study on the "Influence of Type on Production Efficiency." The conclusions from that study were:

- (1) Intermediate-type hogs in general are superior to those of small or large type from the standpoint of the swine producer;
- (2) Small-type hogs are less efficient in general performance, even when slaughtered at approximately 150 pounds, than those of the other two types;
- (3) Large-type hogs must be fed to weights of more than 225 pounds, under good feeding and management practices, to attain sufficient finish to be graded as Choice.

The choosing of a breed. There is not a best breed of hogs for all conditions. A particular breed may, because of certain characteristics, prove to be more adaptable to one set of circumstances. For example, in sections where sun scalding is prevalent, hogs with dark color would be preferred to those with a lack of pigmentation. Some breeds are better suited to grazing or utilization of forage crops than others. The kind and abundance of feed is a factor in breed selection.

Breed comparisons have been made at experiment stations, and it has been found that, within a breed, a great variation exists, both as to the feed requirements and the rates of gain. In cases where one breed has excelled, this is no doubt due to the superiority of the particular strain tested, rather than an actual breed difference. Efficiency in feed utilization and resistance to disease is apparently in no way related to the breed. It will be recalled that the matter of type within a breed may be the cause for most differences in rate and economy of gains, and in most cases, this is a far greater consideration than the matter of breed alone.

Availability of breeding stock is the most important consideration in breed selection. If the breed chosen is quite numerous in the immediate locality, foundation stock will be available from many herds. Greater latitude in choice is possible if the grower starts in the predominating breed of a particular vicinity. After the herd has been established the problem of introduction of new blood through herd boars and additional sows is made less difficult when there are several sources of supply near at hand. It is likewise true that if a grower selects a breed quite prevalent in the county or adjoining counties there will be a larger home market for breeding stock.

In addition to the availability of the breed, the grower should also consider such things as personal favoritism, suitability for local conditions, local market demands, cost, and other factors which would affect success in the hog-raising plan.

THE DUROC

The native home of the Duroc. The Duroc breed originated in the northeastern part of the United States. The two strains



United Duroc Association

This is a Duroc boar.

which perhaps had contributed the most to their ancestry were the Duroc from New York, and the Jersey Reds from New Jersey. Although formed in the eastern part of the country, much of the subsequent improvement of the breed took place in Ohio, Kentucky, Illinois, Iowa, and Nebraska.

Red hogs imported to the United States. Pigs of sandy or red color were brought to this country from several sources.

1. *The Red Guinea breed.* The Red Guinea breed was brought to American shores as early as 1801 from western Africa, according to early writings, by slave-trading vessels. Some of the pigs of this breed were brought to Iowa in 1849.

2. *Spanish Red pigs.* The Spanish Red pigs were imported by Henry Clay in 1837. Four head of this breed were brought to his farm at Lexington, Kentucky. Because this stock proved superior to the common native breeds, it met with favor and became widely disseminated in the South, especially in the states of Kentucky and Virginia.

3. *Portuguese breed.* Another red or sandy-color breed was imported by the Honorable Daniel Webster, Minister to Portugal, about 1852 for his farm in Massachusetts. Following the

death of Webster the imported stock was disposed of by his heirs. Although the first importation went to Vermont and New York, the progeny became widely distributed in the western states.

4. *Berkshire*. Early Berkshires, especially those from Staffordshire, England, were sandy or red in color. We now have a red Berkshire breed in this country, developed mainly in Kentucky. Without question, the Berkshire was a very potent force in the development of red breeds and strains that were later joined together in the Duroc-Jersey.

5. *Tamworths*. The Tamworth breed was brought to this country at a rather early date, and it is possible that some Tamworth blood may have been used, directly or indirectly, in the formation of the Duroc-Jersey. Thomas Bennett, Rossville, Illinois, imported seven Tamworths in March, 1882, which were crossed with the so-called American Red.

These different breeds of red hogs were brought here between 1800 and 1860, and established themselves in certain places. In some cases their identity was soon lost, but in certain sections the red color prevailed and later new strains were derived therefrom.

Strains united to form Duroc-Jersey. It is generally conceded that the Duroc-Jersey came into being from the consolidations of the following:

1. *Jersey Red breed or family*. The Jersey Red is the name given to the red hogs of New Jersey, New York, and other eastern states by John B. Lyman, Agricultural Editor of the *New York Tribune*. R. J. Evans states these were descendants of a pair of pigs imported from England in 1832. Lippincott of New Jersey was the first man to advertise Jersey Red hogs.

F. D. Curtiss, in reporting on this breed to the National Swine Breeders' Convention in 1872, states that D. M. Brown, of Windsor, New Jersey, had known these pigs since 1822.

2. *The Duroc breed of red pigs*. The Duroc name was undoubtedly given by Isaac Frink, a prominent farmer living at Milton, Saratoga County, N. Y. In 1823 he obtained a red boar pig from a litter of ten, the product of a pair of red pigs purchased in 1822 from Harry Kelsey, Florida, N. Y. The origin of



This Duroc sow, Seco Lady, was grand champion at the *Missouri State Fair*.

these pigs is not definitely known. According to D. R. Tinkey "they were English Berkshires, imported a few years before." Kelsey owned the famous stallion Duroc, sire of Eclips, who had won a race from Sir Thomas, an imported horse of note. Frink named the descendants of his boar "Duroc," in honor of this horse. This boar was crossed on common sows and the offspring resembled him. The Durocs were finer in bone and carcass than the Jersey Reds.

In 1830 William Ensign of Stillwater, Saratoga County, New York, secured a pair of red pigs from Connecticut, where they were known as Red Berkshires. He bred these animals extensively and crossed them with the Duroc, or Frink, hog.

3. *Red Rocks from Vermont*. These entered in also, but very little has been written about them.

Duroc-Jersey (1877)	{ Jersey Red (1822) { Duroc (1823) { Vermont Rocks	{ Red Guinea Pigs (1804) { Spanish Red Pigs (1837) { Portuguese Pigs (1852) { Berkshires { Tamworths
------------------------	--	--

In 1934 with the union of the two breed associations the Jersey part was dropped from the name.

The breed was given the name in 1877, when several of the breeders first met to form an association. The American Association was formed in the fall of 1891, and the first volumes were distributed at the World's Fair, Chicago, Illinois, October, 1893. It was at this show that the Duroc-Jerseys first made an impressive exhibit. The National Association was formed on November 20, 1891. The United Duroc Association was formed from the two existing associations in 1934.

DUROC STANDARD OF PERFECTION

POINTS

HEAD AND FACE 3 points:

Head small in proportion to size of body, wide between eyes, face moderately dished and tapering well down to nose; surface smooth and even. Objections—large and coarse; narrow between eyes; face straight, crooked nose or too much dish... 3

EYES 2 points:

Prominent, bright and open. Objections—weak and obscure 2

EARS 2 points:

Medium; moderately thin, pointing forward, downward and slightly outward, carrying a slight curve; attached to head neatly. Objections—very large, round or erect; too swinging or flabby; not of same size, or different in positions, and not under control of animal..... 2

NECK 2 points:

Short, thick and very deep; slightly arching. Objections—long, shallow, and thin..... 2

JOWL 2 points:

Broad, full and neat, carrying fullness back to point of shoulders. Objections—too large, loose and flabby, or too small, thin, and wedging..... 2

SHOULDERS 6 points:

Moderately broad, very deep and full, and not extending above line of back; carrying thickness well down. Objections—open, small, thin or shallow; extending above line of back; boars, heavily shielded..... 6

CHEST 7 points:

Deep and broad, filling full behind shoulders. Objections—flat, cramped, or not extending well down between fore legs 7

BACK AND LOIN 14 points:

Medium breadth; slightly arching; carrying even width from shoulder to ham; surface even and smooth. Objections—narrow; creased behind shoulders, weak or swayed..... 14

SIDES AND RIBS 9 points:

Sides deep; good length, full between shoulders and hams and down to line of belly. Ribs long and sprung in proportion to width of shoulders and hams. Objections—flabby; creased; shallow and not carrying proper width from top to bottom 9

BELLY AND FLANK 4 points:

Straight and carrying out full to lines of sides. Flank well down to lower line of sides. Objections—narrow, tucked up; sagging or flabby. Flank tucked up or drawn in..... 4

HAM AND RUMP 10 points:

Hams—broad, full, firm, and fleshed well down to hocks.
Rump—same width as back, with rounding slope from loin to root of tail. Objections—hams narrow, short, thin; not projecting well down to hocks; cut up too high in crotch. Rump steep, narrow, flat or peaked at root of tail..... 10

FEET AND LEGS 10 points:

Medium in size and length; straight, nicely tapering, wide apart and set squarely under the body. Pasterns strong and straight; feet short and straight. Objections—legs extremely long or short, slim, coarse, crooked; as large below knee and hock as above. Set too close together; hocks turned out or in; hoofs long, slim, and weak; toes spreading and crooked.... 10

TAIL 1 point:

Large at base and nicely tapering. Objections—extremely light or heavy 1

QUALITY 8 points:

Smooth in shoulders and sides; trim in jaw; clean-cut head; ample bone development; hair fine, straight, smooth, and

free from bristles. Objections—unevenness in form and fleshing; coarse head; coarse spongy bone; coarseness of skin or hair; hair curly. Disqualifications—swirl in hair. 8

COLOR 2 points:

Cherry red, without other admixtures. Objections—very dark red or shady brown; very light or pale red; black or white spots or flecks over body and legs. 2

SIZE 8 points:

Boars in good breeding condition, 30 months old or over, 800 pounds; boars 24 months old, 725 pounds; boars 18 months old, 600 pounds; boars 12 months old, 450 pounds; and either sex 6 months old, 200 pounds or more. Sows 24 months old or over in good breeding condition, 600 pounds, sows 18 months old, 500 pounds; sow 12 months old, 400 pounds 8

ACTION AND STYLE 3 points:

Vigorous and animated. Objections—dull and sluggish, awkward and wabbling. 3

CONDITION 2 points:

Thrifty with flesh laid evenly over entire body. Objections—unthrifty, scales, sores, and mange, too fat for breeding purposes; hair harsh and sandy. 2

DISPOSITION 2 points:

Quite easily handled or driven. Objections—wild, vicious or listless. 2

SYMMETRY OF POINTS 3 points:

The adaptation of all points combined to make the desired type of model. 3

TOTAL 100

Changes in the breed. Less actual change in the general form of the Duroc has taken place than has occurred with most of our other breeds. This breed is not so old as many of our other breeds, and this, in a measure, is responsible for the lack of radical type changes. No doubt, the early popularity of this breed

was due to the lack of extreme small kind, coupled with great adaptability to farm conditions.

During the era of big-type development some defects were acquired. Too many very rangy individuals were given undue prominence, with the result that ranginess and long leggedness became overdominant in some strains and families. With the switch to the intermediate from the big type there was developed a tendency towards overfatness even at the usual market weights. The last few years have brought about a change, mainly a demand for fleshing qualities to comply with the modern meat type of market hog.

The so-called medium cherry-red color is the most desirable. Darkness or lightness of color are objected to by many. Often animals of dark color, with advancing age, become extremely dark, bordering upon black, which is objectionable. Occasionally white markings occur. Individuals with distinct white or black spots or a swirl on the top of the body or neck are not eligible for registration.

THE POLAND-CHINA

The native home of the Poland-China. The Poland-China breed originated in the southwestern part of Ohio, in the region known as the Miami Valley, comprised principally of the counties of Butler, Warren, and Hamilton. The Miami Valley was ideal in many respects for the birthplace of a swine breed. In fact, other breeds were not suited entirely to conditions found there, and a new breed was formed to fulfill the need for an efficient converter of their feed into pork products. This section was very fertile and especially well suited for corn raising. With the development of a hog adapted to these new circumstances, not only was a new breed formed but also a new type of hog—the lard-type hog. It is claimed that the Miami Valley was the first corn belt of commercial importance.

Poland-China origin. In the early part of the 1800's two well-recognized breeds of swine, the Russian and the Byfield, predominated in this section. The Shaker Society introduced some of the Big China breed in 1816. These crossed well with the Russian and Byfield, producing good-sized hogs, which were superior feeders. This foundation gave rise to the so-called

"Warren County" hog which established a wide reputation as a breed suitable for the conditions of southwestern Ohio. The Spotted Poland-China, according to some authorities, descended, in part, from the Warren County hog. Hogs were driven to market in those days and were compelled to travel long distances. The ability to travel and the large size were the meritorious characteristics of the Warren County hog. Further improvement was made by introducing some Irish Grazier blood in 1839 and Berkshires in 1835. The latter, no doubt, established the color of the Poland-China and also increased the early maturity and quality.

Pedigree form. The origin of the Poland-China may be presented in the form of a pedigree, as follows:

Poland-China: For a time called "Magic Hog" by some.	Berkshire (1935): Large in size. Color range—from spotted or red in color to black, with six white points. Irish Grazier (1839): Large white hog.	Big China (1816): Mostly white with some sandy to black spots. Byfield: Large type, white color, large size. Small type, small size. Russian: White color, extra large. Common stock: Inferior to the stock brought in.
	Warren County Hog: White or Spotted. Large in size.	

Several other names have been applied to strains, and perhaps, breeds, used in the formative period. The Warren County hogs were often referred to as the "Miami Valley" hog, the "Magic Hog," and other names, often encountered in early histories of the breed.

Other breeds and strains in the formation of the Poland-China



This Poland-China boar was grand champion of the Nebraska State Fair.

include the Bedford, or Parkinson or Woburns, and Neapolitan. No definite measure is available as to the influence of these various breeds. Relatively few numbers of some of these breeds were introduced. For example, only four Big Chinas were brought in by the Shaker Society, and William Neff brought in only three of the Irish Graziers. Perhaps others of these breeds were introduced, but no definite historical record has been made.

Establishment of the breed. Most of the breeds which were drawn upon in the formation of Poland-Chinas were very large in size. Color, as expressed by the breeds, strongly favors white. However, as previously mentioned, the Berkshire, largely through the boar, Tom Corwin 2nd, established the basic color. In some localities, crossing with outside blood was eliminated about 1842. However, the date 1846 has been fixed as the time when all crossing with other breeds was discontinued.

Although 1850 is generally considered as the date of origin of the breed it was not until November, 1872, that the name was definitely established by the National Swine Breeders in convention at Indianapolis, Indiana. At that meeting a specific committee, previously selected, reported on the origin of the breed and proposed that the name as it stood be accepted, in spite of the fact that no recognition was given to the influence of Poland



This Poland-China sow, Surprise Lady, was grand champion at the Iowa State Fair.

blood. Asher Asher, a native of Poland and a prominent breeder in Butler County, Ohio, about 1840, is supposedly responsible for this part of the name.

The first pedigree was written by Carl Freigau, and was presented to a group of breeders at the home of W. C. Hankinson, Blue Ball, Warren County, Ohio, in the month of September, 1876. From this start the Ohio Poland-China Record Association came into being, with Carl Freigau as secretary. In January, 1878, the American Poland-China Record Association was organized at Cedar Rapids, Iowa. The Poland China Record Association was formed in July 1, 1946 and absorbed the existing associations.

SCORE CARD OR STANDARD OF PERFECTION FOR POLAND-CHINAS

POINTS

HEAD AND FACE 3 points:

Head in proportion to size of body, wide between the eyes, face slightly dished, tapering sharply to nose, not too long faced, surface smooth and even. Objections—coarse, narrow between eyes, long rat-shaped nose..... 3

EYES 2 points:

Prominent, bright, open. Objections—weak and obscured by fat 2

EARS 2 points:

Medium size, lairly thin, pointing downward and slightly outward and neatly attached to head. Objections—very large, too thick, too flabby, covering eyes too much, not under control..... 2

JOWL 2 points:

Broad, firm, neat, carrying fullness back to point of shoulders. Objections—too large, flabby, loose, or too thin, small, and wedgy 2

NECK 2 points:

Short, thick, slightly arched, deep. Objections—long, thin, depressed in front of shoulders..... 2

SHOULDERS 6 points:

Reasonably broad, full and deep, carrying thickness well down the leg, not extending above back line. Objections—small, shallow, extending above back line, open. For boars, too shielded..... 6

CHEST AND HEARTGIRTH 9 points:

Deep, broad, well-filled behind shoulders, widely spaced between forelegs. Objections—flat, constricted, narrow, lack of depth 9

BACK AND LOIN 12 points:

Reasonable breadth, slightly arched, even and full from shoulder to ham. Objections—narrow, creased behind the shoulders, swayed, or weak..... 12

SIDES AND RIBS 8 points:

Sides deep, good length, full from shoulder to ham and down to belly line. Ribs well sprung and long. Objections—flabby, thin at belly line, creased, shallow..... 8

BELLY AND FLANK 4 points:

Straight belly line carrying out full to lines of side. Flanks well let down and full. Objections—narrow, tucked up, sagging or flabby, not firm. Flank cup up or drawn in..... 4

HAM AND RUMP 10 points:

Ham—full, firm, thick, broad, and fleshed well down to hock. Rump—same width as back, with easy rounding slope to tail. Objections—hams narrow, thin, short, not fleshed to hock, and cut up in crotch. Rump—too steep, narrow, flat at tail root. 10

FEET AND LEGS 10 points:

Medium in size and length, flinty bone, straight, wide apart, and placed squarely under the body. Pasterns short, strong, straight, feet short, straight, toes together. Objections—extremely long or short legs, too small or too coarse, crooked, not nicely tapering, too close together, turned in or out. Toes crooked or spreading. 10

TAIL 1 point:

Large at base and nicely tapering. Objections—too large or too small, not tapering. 1

QUALITY 8 points:

Smoothness, smooth shoulders and sides, neat jawl, clean-cut head, ample bone but not coarseness, smooth fine straight hair, skin not coarse. Objections—uneven fleshing, coarseness in head, body, and bone; coarse skin; coarse, curly hair. Disqualification—swirl in hair. 8

COLOR 2 points:

Color, black with blazed face, four white feet, white bush on tail. Objections—white spots on body or too much white on legs and head. 2

SIZE 8 points:

Animals in good breeding condition—Boars over 2 years old, 800 pounds up; Boars 18 months, 600 pounds up; Boars 12 months, 450 pounds up; Sows, 2 years old and over, 600 pounds and up; Sows 18 months old, 500 pounds and up; Sows 12 months old, 400 pounds and up. Pigs of either sex 6 months old, 200 pounds or more. 8

ACTION AND STYLE 2 points:

Vigorous, free motion in action, graceful. Objections—sluggish, awkward. 2

CONDITION 2 points:

Thrifty as evidenced by an even fleshing over entire body and silky coat of hair. Objections—scales, mange, too fat for breeding, harsh hair and skin, unthriftiness..... 2

DISPOSITION 2 points:

Docile, easily handled and driven. Objections—wild, cross, vicious, or listless..... 2

GENERAL SYMMETRY 5 points:

The balancing of all points combined to make up the desired type of Poland-Chinas..... 5

TOTAL100

Changes in the breed. Since the formation of the Poland-China, radical changes in type have occurred. First, a large-size Poland-China was developed, later came the small kind; then again the large sort met with the approval of the principal Poland-China raisers. The real large sort, or rangy type, has of late met with some modification so that we now have fairly large size continued with quality, or general refinement. Color standards have also been altered. Many were spotted, with both white and sandy, up until 1880 to 1890. However, during that period a demand arose for the color standard of black with six white points, an ideal which was quite rigidly adhered to for a long period. About 1920 a greater tolerance developed for the amount of white but more recently there has been more demand for those with a limited amount of white markings. The white should not make up over 10 per cent of the entire surface, and should be confined mostly to the head, tail, and legs.

CHESTER WHITES

Native home. The Chester White breed originated in the southeastern part of Pennsylvania, in the counties of Chester and Delaware. Although the native home was in Pennsylvania and much of the early development of the breed took place in that state, Ohio also shared in this regard. Improvement of the breed was also carried on in several midwest states, particularly Indiana, Illinois, Iowa, and Nebraska.



This is a Chester White boar.

Origin. There is a difference of opinion as to the origin of the Chester White breed. However, according to F. F. Moore, formerly secretary of the Chester White Record Association, "the sum total of evidence shows that the large white hog in the eastern states, and especially in Pennsylvania, early in the 1800's, was principally a mixture of the offspring of the English Yorkshire, Lincolnshire, and Cheshire hogs." Many other breeds are credited with having contributed to the ancestry of this breed, and therefore it can be stated that this breed came into being from the amalgamation of many breeds, most of which were white in color. The breed was given the name "Chester County White" in 1848, the word "county" later being dropped from the name. It was not until 1884 that the first record association was formed. Many record associations entered the field, which, together with the development of strains within the breed (the OIC's and Todd's Improved), tended toward discord. Near the latter part of the 1800's, after a boom period in breed expansion, the popularity began to wane. Soon after the start of the 1900's interest in the breed was again renewed.

Chester White score card. The score card for Chester Whites from the Chester White Record Association follows:



This Chester White sow, Miss Typesetter, was grand champion at the Iowa State Fair.

IDEAL CHESTER WHITES

1. GENERAL APPEARANCE

- a. *Big for age*—6 month boars 225 lbs., gilts 200 lbs.; 12 month boars 500 lbs., gilts 400 lbs.; mature boars 900 lbs., sows 700 lbs.
- b. *Balanced Form*—Pleasing relation between length, depth, width of body. Avoid extremes of type.
- c. *Smooth in Form*—Trimness of outline—devoid of creases. All parts symmetrical with each other.

2. HEAD FEATURES

- a. *Size*—Medium, with trim, smooth, firm jowls. Wide between eyes.
- b. *Dish of face*—Medium and neatly turned.
- c. *Ears*—Medium size, neatly broken, clearing eyes.
- d. *Eyes*—Bright, wide open, not obstructed with fat.

3. NECK

Short, neatly blended with head, shoulders.

4. SHOULDERS

Compact on top, smooth and evenly blended with neck and sides, devoid of creases.

5. BACK

Evenly and smoothly arched from neck to tail head. Avoid extreme, highly arched back. Back should show a right angle spread of ribs and be extremely meaty.

6. CHEST

Wide between front legs, deep at fore flank with full heartgirth.

7. SIDES

Low at flanks, even with shoulders and hams free from creases.

8. RUMP

Evenly turned with arch of back, not steep. Width of rump and smoothness at tail desirable.

9. HAMS

Wide, deep, thick, plump, firm, and filled close to the hocks, leaving little or no shank between ham cushion and hock.

10. FEET AND LEGS

Legs straight, set well apart. Pasterns straight, short, strong. Feet compact, toes on same foot close together. Avoid buck, calf, or knock knees, sickle hocks, long low pasterns, and soft sprawling feet. Legs in length should be no more than $\frac{1}{3}$ the full height of animal. Ruggedness and quality of bone beneath knees and hocks very desirable.

11. COLOR

Clear white hair coat and skin. Hair color other than white, unless stained, disqualifies. Freckles on hide objectionable.

12. SEX CHARACTER

Boars rugged, with head features, bone and primary sex characters well developed. Activity on feet also a masculine characteristic. Sows refined in head and hair coat, roomy of middle with well developed udders. Not less than 12 sections, preferably more on both boars and sows.

13. HAIR COAT

Straight, fine, particularly on sows.

14. DISQUALIFICATIONS

- a. Not $\frac{2}{3}$ big enough for age.
- b. Upright ears.
- c. Swirls above flanks.
- d. Off-colored hair; spots on skin larger than a silver dollar.
- e. Cryptorchidism in males.
- f. Hernia in males or females.

15. MOST UNDESIRABLE CHARACTERISTICS

- a. Crooked legs, broken feet.
- b. Constricted heartgirth.
- c. Fishback.
- d. Pinched loin.
- e. Seamy shoulders.
- f. Open shoulders.
- g. Curly coat.
- h. Coarse-stepping gait.
- i. Bad eyes.
- j. Shallow, narrow body with high flanks.
- k. Cat hams.
- l. Baggy rear udders on sows.

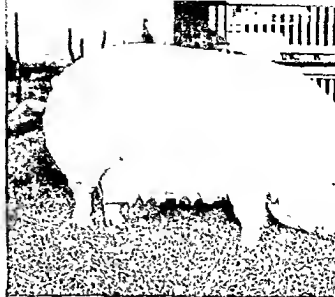
Chester White changes in the breed. The Chester White was influenced by the demand for the small type of hog, and from 1900 to 1915 that type predominated. To meet the increasing demand of the farmer for larger size and more modern type, a decided change was made. The type desired now is that of the meat type which is intermediate in size and will yield a desirable carcass with sufficient length and leanness.

OIC SWINE

The OIC breed was formerly referred to as the Ohio Improved Chester White, but they are now designated as OIC to avoid confusion with the Chester White breed.

The Ohio Improved Chester White was developed by L. B. Silver of Salem, Ohio, beginning about 1863. In 1865 Mr. L. B. Silver made a trip through the eastern states to study the pure breeds of swine. Parent stock was selected in Chester and Delaware counties, Pennsylvania. Subsequent selections were made from the best herds. It is reported that Mr. Silver created the dis-

inct OIC type by crossing on the Chester White another breed of hog which was known in England as the Mammoth White. The use of the other breed was not accepted legally. The Federal Trade Commission of the federal government in 1923 ruled that the



OIC Swine Breeders Association

This is a prize-winning OIC sow.

so-called OIC was one and the same as the Chester White. Subsequent action of the United States Circuit Court of Appeals gave the OIC breeders the right to sell and advertise OIC swine as a separate and distinct breed, since there was sharp and irreconcilable conflict in the expert opinion as to what constituted a separate and distinct breed. For registration in the OIC breed the sire and dam must be recorded with the OIC-Swine Breeders' Association.

The Association score card description of the model-type follows:

OIC-SCORE CARD

Color.....	8	Loin	6
Head and face.....	4	Belly	4
Eyes.....	3	Flank.	2
Ears.....	2	Ham and rump....	9
Jowl.....	3	Tail	1
Neck.....	3	Legs.	8
Shoulders.....	7	Feet	8
Chest and heartgirth.	9	Action... . .	3
Side and rib.....	8	Symmetry.	3
Back.....	9		

100

OIC DESCRIPTION OF THE MODEL TYPE

COLOR: White. Coat fine; either straight or wavy with preference for straight; evenly distributed and covering the body well.

HEAD AND FACE: Head short and wide; cheeks neat (not too full); jaws broad and strong; forehead medium, high, and wide; face short and smooth; wide between eyes; nose neat, tapering, and slightly dished.

EYES: Bright, large, clear, and free from wrinkles or overhanging fat.

EARS: Medium size; soft; not too thick; not clumsy; pointing forward and slightly outward; drooping gracefully and fully under control of the animal.

JOWL: Smooth; neat, firm; full; carrying fullness well back to shoulders and brisket when head is carried up level.

NECK: Wide; deep; short and nicely arched; neatly tapering from head to shoulder.

SHOULDERS: Broad; deep and full; extending in line with the sides, and carrying size down line of belly.

CHEST AND HEARTGIRTH: Full around the heart and back of the shoulders; ribs extending well down; wide and full back of forelegs.

BACK: Broad. A uniform slight arch from neck to root of tail; free from lumps and rolls. No drop behind the shoulders.

SIDE AND RIB: Rib well sprung. Sides full, smooth, deep, and even with line of ham and shoulder.

LOIN: Broad and full.

BELLY: Same width as back; full; straight; drooping as low at flank as at bottom of chest; line of lower edge running parallel with sides.

FLANK: Full and even with body.

HAM AND RUMP: Broad; full; long; wide and deep; admitting of no swells; buttock full; neat and clean; stifle well covered with flesh, nicely tapering toward the hock; rump slightly rounding from loin to root or tail, same width as back, making an even line with sides.

TAIL: Small; smooth; nicely tapering; base slightly covered with flesh; carried in a curl.

LEGS: Medium length. Strong and straight, set well apart and well under body; bone of good size; firm; well muscled; wide above knee and hock; straight knuckles; enabling animal to carry weight with ease.

FEET: Short; firm; tough; animal standing up on toes.

ACTION: Easy and graceful; high carriage; active; gentle and easily handled.

SYMMETRY: A fit proportion of the several parts of the body to each other, forming a harmonious combination.



Here we see a Hampshire boar.

THE HAMPSHIRE

Native home. A difference of opinion exists as to the native home and actual origin of the Hampshire. The difficulty rests upon the inability to connect, in a definite manner, the Hampshire as we know it in the United States today and a belted breed in Great Britain.

Hampshires are supposed to have descended from a hog native to northern districts of England and Scotland. From the standpoint of origin, some authorities consider the Hampshire to be one of the oldest, and, according to them, the breed was known as the "Old English" hog. Presumably, they were most numerous in Hampshire, England, hence the name. However, the hogs from Hampshire, England, do not resemble the Hampshire of the United States in either form or color.

In Great Britain there are two belted breeds, or "sheeted pigs" as they are commonly called in that country: the Essex, a native of Essex and Cambridge, which is regarded by many as being the progenitor of the Hampshire, and the Wessex Saddleback. The belted hogs were also bred at an early date in north Holland.

Origin. Hogs of a belted color pattern were reported in Massachusetts as early as 1820, and in New York in 1830. Norfolk Thin Rind hogs, supposedly similar in all respects to the



Mullady Farm, Inc.

This Hampshire sow, Carmen Jane, has been twice grand champion at the Illinois State Fair.

Hampshires, were imported to Connecticut from England in 1827. Joel Garnett of Kentucky, through an agent at Philadelphia, purchased 15 head of belted hogs, "Ring Middles" and "Thin Rinds." These hogs were driven to Pittsburgh and then sent by boat to Kentucky. They increased greatly in numbers, although, according to reports, they were very nearly obliterated through cross breeding, about 1861. Improvement came about by selection within the breed as there was but little outside blood used.

Six Boone County (Kentucky) farmers organized the American Thin Rind Association in 1893. Foundation stock, carefully selected from 12 herds, were allowed registration in this association. This date marks the date of origin of the breed. The name "Thin Rind" was given to the breed by the local packers at Cincinnati, Ohio. Up to 1904 but very little progress had been made, there being but 446 pigs recorded. In 1904 the name of the association was changed to the Hampshire Swine Association. Hampshires were given a classification at the International Livestock Exposition in 1901, at the World's Fair in 1904, and at the Illinois State Fair in 1905.

STANDARD OF PERFECTION FOR HAMPSHIRE HOGS

SIZE (according to age and condition)		10 points:	
		<i>Boars</i>	<i>Sows</i>
Aged (over 2 years).....		800-900 lbs.	700-750 lbs.
Senior yearling (under 2 years)...		700-750 lbs.	575-625 lbs.
Junior yearling (18 months).....		600-700 lbs.	525-575 lbs.
Senior pigs (12 months).....		450-550 lbs.	425-525 lbs.
Spring pigs (6 months).....		200-250 lbs.	200-250 lbs.
FORM		55 points:	
Head—Medium size and wide between the eyes.....			1
Eyes—Bright and free from wrinkles.....			1
Ears—Medium size, erect, slightly inclined outward and forward			1
Neck—Short, blending with head and shoulders.....			2
Jowl—Neat, trim, and firm.....			4
Shoulders—Deep, medium wide, smooth, and blending with neck and body.....			4
Chest or heartgirth—Large, roomy; full girth....			4
Back and loin—Back medium wide and slightly arched; balanced length; back should show a well-sprung rib, a natural turn, and should avoid any tendency toward an extreme right-angle spread or a fishback; uniform in width with shoulders and hams, loins full muscled.....			12
Sides—Deep, long, straight, and smooth....			9
Belly and flank—Straight, trim, and full.....			5
Ham and rump—Wide, long, and deep, with muscle; high tail setting; hams well muscled; loin should be free from wrinkles, flabby skin, and excess fat; a deep, firm, wide crotch			12
FEET AND LEGS		15 points:	
Legs medium length, straight, set well apart, and squarely under body.....			5
Medium bone.....			5
Short, straight pasterns, toes short, strong.....			5
QUALITY AND SMOOTHNESS		10 points:	
Smooth, firm muscled throughout....			5
Head clean cut.....			1
Bone rugged, but clean, sound, and strong.....			3
Condition thrifty, hair coat fine, straight, and smooth.....			1
SEX AND BREED CHARACTER		10 points:	
Masculine or feminine.....			1
Color black with white belt entirely circling body including both front legs.....			1

Erect ears.....	1
Firm and meaty throughout.....	2
At least 12 good, well-spaced teats; teat line well forward....	3
Active, vigorous.....	2

TOTAL	100
-------------	-----

Defects. Conditions which should be discriminated against in accordance with the seriousness of the defect of how far the animal is away from the ideal in this respect. Score card values will help determine the relative importance of the various defects in comparative judging.

SIZE

1. Below standard weight (*age and condition considered*).

HEAD AND NECK

1. Large, coarse head.
2. Dished face.
3. Narrow between the eyes.
4. Vision impaired by wrinkles around the eyes.
5. Overly large, coarse, thick drooping, or too small ears.
6. Neck too long or ewe neck.
7. Large, sagging, or flabby jawl.

FEET AND LEGS

1. Legs too long or excessively short; crooked legs, bone too fine or too coarse; pasterns too long, slender or crooked; toes spreading, too long, crooked, or turned up.

BODY

1. Shoulders too narrow or thicker than line with sides and hams.
2. Chest too narrow, cramped, or tucked up in foreflank.
3. Heartgirth pinched behind shoulders or at foreflank.
4. Fish back, back surface ridgy or uneven, pinched loin.
5. Side too short, too shallow, flabby, or creased.
6. Sagging belly, flabby, or thin fleshed, tucked-up flank.
7. Rump too steep or narrow at root of tail.
8. Ham too narrow, shank too long, cut too high in crotch.

COLOR

1. Belt too wide, hair-line belts, spots in belt, white hairs mixed among the black, white high on hind legs, white on front of snout (exclusive of skin on front of snout).



This Spotted Poland-China boar, Skippy, was grand champion at the Iowa State Fair.

Changes in the breed. Changes have been made in the color markings and also in the color requirements for registration. All this has been done for the purpose of raising the standard of color marking and to assist in securing a large percentage of belted pigs to the litter. With the tendency toward greater restriction in color marking there has also been a refinement in general conformation. Greater trimness, less lardiness, and finer quality have been acquired in the improvement of the Hampshire.

THE SPOTTED POLAND-CHINA

Native home of the breed. The Spotted Poland-China was developed in the north central part of the country, mainly in Indiana. However, improvement of the breed was carried on in several of the Midwestern states.

Origin. A large part of the stock which made up the foundation for the Poland-China breed was white in color, and between 1845 to 1890 many herds were spotted. The Poland-China went to the extreme in the demand for a small type, and this renewed interest in the sort of hog previously popular. The original Poland-China, which carried a large amount of white, had a repu-

tation for size, ruggedness, bone, and prolificacy. In an attempt to bring back the qualities of the original Poland-China, the Spotted Poland-China was established.

The modern Spotted Poland-China descended from several herds in central Indiana that had preserved the old spotted type for their standard. Some blood of the Gloucester Spotted Hog of England was used. R. E. Arbuckle and Son, of Brownsburg, Indiana, imported these pigs from England in 1914, and they were accepted as foundational animals. In the formative period much of the blood of the big type Poland-China was used. The terms "Old Fashioned," "English," and "Big Type" were formerly used by Spotted Poland-China breeders with regard to breeding animals. This was to identify the ancestry. Also, "Triple Alliance" denoted a blending of the three. Today the terms are seldom mentioned because of the intermixing and the remoteness of such ancestry in the pedigree. The records were closed April 1, 1924, to all except animals from ancestry in the Spotted Poland-China record. The official beginning of the breed was with the organization of the record association in January, 1914.

Pedigree Form of Origin

Spotted Poland-China, 1914.

Foundation stock accepted from the time of formation until April, 1924.

1. Spotted hogs were accepted for registration; measurements, type, color, age, and breeding whenever such could be secured was recorded.

2. Poland-Chinas, Big Types, or Black Poland were frequently used and were, no doubt, the most important source of blood.

3. Gloucester Spotted hog from England. But two of these were used.



This Spotted Poland-China sow, Eulo, was grand champion at the Iowa State Fair.

Show-ring classifications were provided for Spotted Poland-China hogs at the Ohio and Indiana State Fairs in 1915.

SPOTTED POLAND-CHINA STANDARD OF PERFECTION

HEAD AND FACE: Head medium, long, and wide; jaws broad and strong; face smooth and broad between the eyes, slightly dished; nose medium long, surface smooth and even. Objections—head narrow and coarse; jaws narrow and weak; face narrow between the eyes, straight or too much dish; nose coarse, too long or too short.

EYES: Bright and prominent. Objections—dull and obscure.

EARS: Medium size and drooping, well proportioned, attached neatly to the head. Objections—large and thick.

NECK: Thick and very deep. Objections—shallow and thin.

JOWLS: Large, smooth, and neat, carrying fullness back to shoulders. Objections—small and flabby, not carrying fullness to shoulders.

SHOULDERS: Broad, deep, and full, thickness extending well down. Objections—thin and shallow, thickness not extending down; boars, too heavily shielded.

CHEST: Large and deep, extending well down between the legs. Objections—small and shallow.

- BACK AND LOIN:** Back slightly arched, good breadth, carrying even width from shoulder to ham, surface even and smooth. Objections—narrow, creased behind shoulders, swayed, or humped.
- SIDES AND RIBS:** Sides very deep and carrying out fullness to line of belly. Ribs long and well sprung in proportion to width of shoulders and hams. Objections—sides small and creased, not carrying proper width from top to bottom.
- BELLY AND FLANK:** Belly, good width, straight, and full. Flank, well down to lower line of sides. Objections—belly narrow, tucked up, or flabby. Flank tucked up or drawn in.
- HAM**

shallow, thickness not extending well down to the hock. Rump narrow, steep, or peaked at root of tail.

LEGS AND FEET: Legs with large bone, of medium length, firm and well muscled, set well apart. Feet strong, standing up well on pastern, free from defects. Objections—legs, small bone, too long in the pastern, weak toes, crooked or turned up.

TAIL: Long, well proportioned at the base, tapering to the end. Objections—small or too short.

COAT: A good coat of hair evenly distributed over the body. Objections—hair too thin, swirls, not evenly distributed over the body.

COLOR: Perfect color, 50 per cent white, 50 per cent black. Must be 20 per cent white on the body (legs not counted), and not more than 80 per cent white, with well-defined spots equally distributed over the body. Objections—black and white intermingling.

SIZE (Maximum official weight National Swine Show in each class): Aged boars 1130 pounds, Senior yearling boars 910 pounds; Junior yearling boars 725 pounds; Senior boar pigs 560 pounds; Junior boar pigs 240 pounds.

Aged sow 950 pounds; Senior yearling sow 840 pounds; Junior yearling sow 720 pounds; Senior sow pig 540 pounds; Junior sow pig 240 pounds.

ACTION AND STYLE: Action, quick and vigorous. Style, free and easy. Objections—Dull and stupid, awkward, wabbling walk, testicles not easily seen nor of the same size.

CONDITION: Healthy, skin free from scurf and sores, flesh evenly distributed over body.

DISPOSITIONS: Very quiet, gentle. Objections—wild or vicious.

DISQUALIFICATIONS

FORM: Small upright ears, small cramped feet, broken-down feet or deformed in any way.

SIZE: Very small, not over half the size given in the standard.

COLOR: Brown or sandy spots. Less than 20 per cent white on body, or more than 80 per cent white.

CONDITION: Seriously diseased, bareness, or blindness. Sow with swirl may be recorded, but not shown or sold in public sale. Boar with swirl disqualified for registration.

PEDIGREE: Not eligible to record.

Changes in Spotted Poland-Chinas. The Spotted Poland-China is comparatively young. The beginning was in 1914 and the next ten years may be regarded as the formation period. There is no great difference existing between the Poland-China and the Spotted Poland-China. The large, heavy ears, coarse rough bone, heavy shoulders, flat backs, lack of quality, and inferior feet and legs which characterized the early "spots" have been eliminated. The Poland-China has a little larger size, but in general the form, conformation, and type is practically identical. For a time an extreme type was in evidence, but the rangy, upstanding, poor-feeding kind, known by some as the "race-horse," has been replaced by the type of greater adaptability.

THE BERKSHIRE

Native home. The Berkshire originated in the south-central part of England, mainly in the counties of Berkshire and Wiltshire. They were also developed to some extent in the counties of Leicestershire and Staffordshire.

Origin. The Berkshires are one of the oldest swine breeds, and they were used in the improvement of many other breeds of swine. The old English hog formed the foundation for this breed and was improved markedly by crosses with the Chinese, Siamese, and Neapolitan breeds. Oriental crosses were made as late as 1842. As early as 1789 Berkshires were referred to as the most numerous breed in Britain and were distributed generally over all England and in some parts of Scotland; but it was not until 1830 that the breed took definite form.



This Berkshire boar was a recent grand champion of the American Berkshire Association.

Berkshire distribution. From its native home in England, the Berkshire was made by John Brentnall, an English farmer, who settled in New Jersey in 1823. Many subsequent importations followed. In this country N. H. Gentry, of Sedalia, Missouri, developed an American type of Berkshire, and because of his constructive efforts, is recognized as one of the outstanding breeders of all classes of livestock in this country. Further importations of English Berkshires, as well as Canadian Berkshires, were made, particularly between 1908 and 1920. Difference of opinion existed as to the value of the imported stock. A. F. Sinex stated that imported Berkshires excelled in prolificacy, vitality, and early maturity, and that farmers liked them.

The American Berkshire Association has described the Berkshire characteristics as follows:

COLOR: Black with white feet, face, and tip of tail. Skin and hair occasionally shows tinge of bronze or copper color. An occasional splash of white in addition to the six white points is not objectionable. Lack of any of the white points is admissible.

FACE AND SNOUT: Face slightly dished and broad between the eyes. Snout medium length and broad. Extreme pug heads are undesirable. Eyes prominent, clean, and clear.

EARS: Medium in size, setting well apart, carried fairly erect, inclining forward, especially with age.



This Berkshire sow is a prominent prize winner of the American Berkshire Association.

JOWL: Clean, firm, not flabby or hanging too low. Running back well on neck.

NECK: Full, short, and slightly arched. Broad on top. Well connected with shoulders.

HAIR: Straight, smooth, lying close to and covering the body well. Free from bristles.

SKIN: Smooth and mellow.

CHEST: Deep, full, and wide, with good heartgirth.

SHOULDER: Smooth and even on top and in line with side.

SIDE: Deep, smooth, well let down, with straight side and bottom lines.

BACK: Broad, full, strong, slightly arched. Ribs well sprung.

FLANK: Extending well back and low down on the leg, making nearly a straight line with the lower part of the side.

LOIN: Full, wide, and well covered with flesh.

HAM: Deep, wide, thick, and firm, extending well up on the back and holding its thickness well down to the hock.

LEGS AND FEET: Straight and strong, set wide apart, with short pasterns, the hoofs nearly erect, capable of carrying great weight.

SIZE: All that is possible without loss of quality or symmetry, with good length. Mature boars 900 pounds. Mature sows 800 pounds.



A Tamworth boar is pictured here.

APPEARANCE AND CHARACTER: Vigorous and attractive with firm and easy movement. Good disposition.

THE TAMWORTH

Native home. The home of the Tamworth breed is in the central part of England, in the counties of Stafford, Leicester, Warwick, and Northampton. The name of the breed came from the town of Tamworth, which is situated upon the River Tame in Staffordshire, near the northern border of Warwickshire.

Tamworth origin. The Tamworth is regarded as one of the oldest breeds of swine. Some believe that this breed descends from hogs brought into England from Ireland, and that the progenitor of the Tamworth was the Irish Grazier. Robert Peel is credited with such an importation in 1812. However, little is known concerning the early history and development of the breed. The most widely accepted view concerning the origin is that this breed descended from the Old English hog which resulted from the domestication of the wild boar.

No outcrosses were made during the formation of the breed and improvement was accomplished by selection. This breed was first recognized in the show rings of Great Britain in 1849,



Here is a Tamworth sow.

but from that time until 1880 the Tamworth occupied an obscure existence.

United States importations of Tamworths. Thomas Bennett of Rossville, Illinois, later of fame as a breeder of Duroc-Jerseys is given the credit for making the first importation of this breed in 1882. Canada and the United States have made numerous importations.

TAMWORTH STANDARD OF EXCELLENCE

Following is the proposed score card of the Tamworth Swine Association, Inc.

- COLOR: Golden or cherry red hair 2 points.
- HEAD: Fairly long, snout moderately long and quite straight, face slightly dished wide between ears 4 points.
- EYES: Bright, large, clear, free from wrinkles 2 points.
- EARS: Erect, medium in size 2 points.
- JOWL: Firm, neat, not too fat 2 points.
- NECK: Fairly long and muscular, especially in boar 2 points.
- CHEST: Wide and deep 10 points.
- SHOULDERS: Fine slanting and well set 8 points.
- LEGS: Strong and shapely, with plenty of bone, and set well outside the body 3 points.



Solihull Dainty Boy 8th

This is a Yorkshire boar, Solihull Dainty Boy 8th.

- PASTERNS:** Strong 3 points. **FEET:** Strong and a fair size 2 points.
BACK: Long and well arched 4 points.
LOIN: Strong and not too broad 8 points.
TAIL: Set of thigh and well tasseled 2 points.
SIDES: Long and deep 8 points.
RIBS: Well sprung and extending well up to flank 4 points.
BELLY: Deep and straight underline 2 points.
FLANK: Full and well let down 2 points.
QUARTERS: Long, wide, and straight from hip to tail 4 points.
HAMS: Broad and full, well let down to hocks 8 points.
COAT: Straight and fine 2 points. **ACTION:** Firm and free 2 points.
SIZE: Well grown out for age 4 points.
DISPOSITION: Gentle, easily handled 2 points.
QUALITY: Smoothness, smooth shoulders and sides, neat jowl, clean cut head, ample bone but not coarseness, smooth fine straight hair, skin not coarse 8 points.
OBJECTIONS: Large and numerous spots in hair, especially in body, curly coat, slouch or drooping ear, short or turned-up snout, heavy shoulders, wrinkled skin, inbent knees, hollowness at back of shoulders. Animals with swirls not eligible to record. Gilts must have at least 12 functional teats, and boars 12 rudimentary teats. Inverted teats are a disqualification, blind teats a discrimination.

THE YORKSHIRE

Native home and origin. The Yorkshire is an English breed of bacon hogs that originated in Yorkshire and neighboring



Curtiss Candy Company

This photograph shows a Yorkshire sow, P. Nova.

counties in England nearly a century ago. The foundation consisted of large white hogs with black or bluish spots on the skin, which were derived from the Old English hog. They were heavy boned, with large drooping ears, long legs, and narrow backs and loins. This stock is said to have been improved by the use of some Berkshire blood as early as 1842, and later of some white Leicester hogs. The latter were large but fine of head and with erect ears. Later, to improve their fattening qualities, boars of the small Yorkshire breed were also used.

United States importations of Yorkshires. Yorkshires were imported in the United States at a comparatively early date but have never become widely distributed. Wilcox and Liggett, in 1893, brought in the first importation of this breed, to Minnesota. The Yorkshire is better adapted to bacon than to lard production. In Canada, where the bacon type of hog predominates, the Yorkshire has become the standard breed. Most of the herds in this country are found in the small grain-growing and dairy-ing sections. The Large Yorkshire predominates on this continent. In England, Middle and Small Yorkshires, or Whites, are also quite common at present.

Yorkshire characteristics. The predominating characteristics of the Yorkshire are its large frame and the prolificacy of the sows. The pigs are fine rustlers and compare favorably with any breed in their ability to make rapid gains. Judged by lard-type

standards the pigs do not fatten early, but when the Yorkshire is crossed with any of the lard breeds, the pigs admirably suit the requirements of the corn-belt feeder and packer.

SCORE CARD FOR YORKSHIRE BOARS AND SOWS

Perfect
Score

1. General Appearance: Attractive individuality, expressing meat type, through length and depth of body; with pronounced femininity and maternal characteristics; with balance of parts and symmetry of form; showing vigorous, straight, and active walk 35

BREED CHARACTERISTICS

COLOR: Hair coat entirely white, straight and medium fine, indicating quality. Clear white skin is preferred, but some pigmentation in the skin is permissible.

SIZE: Sufficient length, depth, and balance of body to give ample size and scale for age.

HEAD: Feminine, medium length, clean cut, free from wrinkles; snout straight or slightly dished, carrying down broad between the eyes; eyes full and bright; jaw lean, muscular, free from flabbiness, ears moderately fine, held erect, covered with medium fine hair; neck muscular but clean cut with no tendency to arch top.

SKIN: Smooth,

rib;

ing;

..... .

SIDE: Long, deep, and smooth; uniform depth of fore and rear flank with a straight underline; teats clearly defined with at least 6 on each side.

HAM: Full, deep, and firm, carrying well down to the hock; free from wrinkles and flabbiness.

2. Productive Ability: Indications of health, vigor, ruggedness, and ability to make rapid, efficient, and economical gains and to farrow and suckle large litters 20

HEAD: Broad at nostril, jaws strong and well set; good width between the eyes; features showing pronounced femininity.

HEART GIRTH: Deep, wide across floor of chest, fore flank well let down, fore rib well sprung blending smoothly with shoulders.

ABDOMINAL CAPACITY: Well-sprung ribs, slightly arched back, even in width and strong at loin; sides long, deep, and smooth, even from shoulder to ham; rear flank deep and well filled. Indications of capacity to utilize ample feed and carry large litters.

UNDERLINE: With not less than 6 prominent, well-spaced teats on each side, beginning well forward.

3. Carcass Character: Indication of ability to produce a high percentage of lean pork cuts of the type and quality that best meet consumer preference 20

FORM

TOP: Long, moderate, and even in width, giving extra length and a full, well muscled loin.

SIDES: Long, firm, smooth, and of uniform depth for a higher yield of quality bacon.

HAMS: Long, full, deep, and firm, carrying well down to the hock from a high tail setting and having same width as rest of the body. Free from wrinkles and flabbiness.

SHOULDERS: Free from coarseness and laid in smoothly.

QUALITY: Indicated by feminine characteristics, smooth, straight hair coat; jowls trim and firm; shoulders smooth, free from coarseness and wrinkles; sides smooth; hams firm, smooth, and free from patchiness; bone sufficient; showing trimness throughout.

BALANCE: All parts blending harmoniously to make a smooth and symmetrical individual.

4. Feminine Sex Character: Pronounced femininity as shown by quality, clean-cutness, and fineness of features; broodiness as shown by a large, roomy middle and well-developed mammary system 15

UPPER: Should show quality in each section with all teats capable of proper functioning. Having not less than 6 well-developed, properly spaced teats on a side and beginning close to the fore leg.

Masculine Sex Character: Pronounced masculinity as shown by vigor, animation, strength, and ruggedness.

TESTICLES: Prominent, well developed, uniform in size, evenly supported, and carried at medium height.

5. Leg and Feet: Set well apart, straight, and of medium length with sufficient bone, free from extreme coarseness or fineness 10

PASTERNS: Strong and erect.

FEET: Well formed and toes close.

MOVEMENT: Free and showing a vigorous, straight, and active walk.

Total 100

The following defects will disqualify any pig from being recorded: 1. Swirls above the belly line. 2. Off-color hair. 3. Cryptorchidism. 4. Hernia in either sex.

The Yorkshire must always be distinguished as a thick-fleshed, leaner-meated hog. Its function is to produce an abundance of leaner meat in bacon sides, hams, loins, and shoulders and a relatively small percentage of lard and fat-backs. Judges are required to disqualify any Yorkshire exhibited so fat as to depart significantly from the lean-meat characteristics of the breed.

HEREFORD HOGS

A comparatively new breed of hogs, Hereford, was originated by R. U. Webber, La Plata, Missouri. Webber states that the foundation was "A cross of the white and red-blooded stock



This Hereford boar, Prince, was grand champion boar at the Iowa State Fair.

Duroc, Chesters, and OIC's and a peculiar blood strain or graft. The latter being withheld until further experience can be had along that line." It is claimed by the founder that the breed was originated as early as 1902. The ideal color desired by the founder of the breed is one with a cherry-red body, white face, lower part of the body white, white feet and legs, and about one-half of end of tail also, with white extending back to a point between the shoulders.

The original association, Universal, was organized in 1920. In 1934, the National Hereford Hog Record Association was formed. The pedigrees of the original association are now not recognized by the National. The new group accepted as foundation stock some over a hundred head of well-marked sows and boars, owned by six breeders and recorded in the Universal Association. It is a requirement of the younger association that all animals offered for entry must have some white in the face and must be not less than two-thirds red. The ideal markings are white head including ears, white feet, underline, and switch of tail. All other parts are red, either light or dark, the latter preferred. Some white belts and black color occurs in Herefords indicating that some Hampshire blood was used. Hereford hogs



This Hereford sow, Domino Lady, was grand champion sow at the Iowa State Fair.

were first exhibited at the Iowa State Fair in 1931. A classification was made for them at that show in 1939.

HEREFORD HOG STANDARD OF PERFECTION

HEAD: Short, broad between the eyes, tapering to nose, face slightly dished.

EYES: Bright, large, smooth.

EARS: Medium in size and thickness, wide apart at base standing out from the head and pointing forward with no tendency to point toward each other and lop over face.

JOWL: Neat and firm, smoothly running into neck, not flabby, or hanging too low.

NECK: Short, full, and broad on top. Well-connected with shoulder and head.

CHEST: Wide and deep, well let down in line with belly carrying good width between forelegs and on back between elbows.

SHOULDERS: Broad and deep, with no openness on top, smoothly laid in both at top and with sides. Appearance of being almost flat on top.

BACK: Broad, long, carrying even width from shoulder to ham with a very slight arch.

LOIN: Full, broad, and strong. Well-covered with flesh.

RUMP: Same width as back with rounding slope from loin to root of tail.

HAM: Plump and full. Well-rounded on both inside and outside.

carried full and rounded well down to hock, not flabby or wrinkled.

RIBS: Arched and well sprung, giving width to back and long to give depth to the chest.

SIDES: Long, deep, and straight down to belly line with flank extending well down on leg to give fullness and straight underline.

UNDERLINE: Wide and level, giving appearance of a straight line from neck to rear flanks and full all the way back.

LEGS: Medium to short in length, straight and strong, good bone but not coarse. Set wide apart squarely under the body.

FEET: Short and strong in pastern with hoofs nearly straight, capable of carrying great weight.

TAIL: Set high, of medium size, and well-tasseled.

COAT: Plentiful, fine, straight, and glossy.

COLOR: Cherry red with white markings. White confined to face, inside of ears, under side of jowl, neck and belly, legs to the belly line, and tassel of tail. Rest of body deep cherry red.

QUALITY: Good breeding shown by fine hair, clean head, neat ears, clean, strong bone, and smooth skin free from wrinkles.

APPEARANCE: Attractive. When viewed from the side has the appearance of an oblong with well-rounded corners, and with the addition of the trimmings, or snout, ears, tail, and legs, you have a long, deep, thick, short-legged, easy-feeding type of pleasing appearance.

STYLE: Vigorous, with a straight active walk.

DISPOSITION: Very quiet, gentle, easily handled.

CONDITION: Thrifty. Clean skin with flesh evenly distributed over the entire body.

SIZE: All that is possible without loss of quality.

THE LANDRACE

This is a comparatively new breed in the United States. The first Landrace hogs were imported from Denmark in 1934. Recent importations have been made directly or through Canada and Great Britain from Norway, Sweden, and Denmark. The American Landrace is a long, muscular, white breed. They are very prolific, and the sows are excellent mothers. Mature boars weigh 700 to 900 pounds and the mature sows, 550 to 750 pounds.

The American Landrace Association, Inc. was formed in

1950. In the disqualifications of the breed are listed: crooked, short, broad, turned-up snouts; upright ears; black hair; cryptorchidism, but a few freckles in the skin are tolerated; short bodies (16 to 17 pairs of ribs are desired); very deep sides; underdeveloped udders, with less than 12 teats; very sickled hocks; very broad shoulders; sway back; small hams; not large enough for age; wild, excitable disposition.

NEW BREEDS OF SWINE

Several new breeds have been developed from a crossbred foundation of two or more breeds. Following the original crosses, inbreeding and production testing were practiced to the end that a productive, meat-type hog was developed. In many instances the Danish Landrace breed entered into the crosses. These breeds are registered by the Inbred Livestock Registry Association.

Some of the more numerous of these new breeds with description of each follows:

Minnesota No. 1. This breed was started by the Minnesota Agricultural Experiment Station in 1936 from a Danish Landrace foundation. Following the original crosses, inbreeding was practiced to fix definite characteristics. Selection was practiced, based upon fertility, survival of pigs, growth rate, economy of gain, and also conformation. The approximate proportion of blood is 52 per cent Tamworth and 48 per cent Landrace.

Red is the predominating color, with occasional small black spots. The breed is long bodied, short legged, and has full hams, light shoulders, light strong bones, and a relatively straight back. The face is long, jowls are trim, and ears are rather large but thin and of good quality.

Minnesota No. 2. This breed was also developed in Minnesota and was started in 1941 from an inbred Canadian Yorkshire boar and some inbred Poland China gilts. The breed has 40 per cent Yorkshire blood and 60 per cent Poland China blood. The color is black and white. Compared with the Minnesota No. 1, the legs are longer and the snout somewhat shorter. The ears are medium sized and carried erect.

Montana No. 1 or Hamprace. The breed was developed from crosses first made in 1936 with the Landrace and black Hampshires. It now is 55 per cent Landrace and 45 per cent Hampshire. The breed is solid black in color.

Maryland No. 1. The Landrace-Berkshire cross was the basis for this breed, which carries 62 per cent of the former and 38 per cent of the latter. As indicated by the name, they were developed in Maryland co-operatively by the Maryland Agricultural Experiment Station and the U. S. Department of Agriculture at Blakeslord Farms, Queenstown, Maryland. They are black and white spotted and intermediate in conformation between the two breeds.

Beltsville No. 1. The breed was started in 1934 and was recognized in 1951. It is from an inbred Landrace-Poland China line developed by the U. S. Department of Agriculture at Beltsville, Maryland. It carries about 75 per cent Landrace blood and 25 per cent Poland China blood. The breed is black with white spots. The amount of white varies from 10 to 40 per cent and is rather uniformly distributed over the entire body. As would be expected in body conformation, they are somewhat similar to the Landrace.

Beltsville No. 2. This is a combination also developed by the U. S. Department of Agriculture from the inbred Danish Yorkshire, Duroc, Landrace, and Hampshire breeds. This line was started in 1940 and was recognized in 1952. The principle color is red; however, there is white along the underline and there may be some occasional black spotting. The ears are very erect and fairly short. The head is intermediate in length and the jaw moderately trim. The shoulders are smooth and well muscled, and the sides are moderately deep with a straight underline and well-muscled flanks. The legs are of medium length.

San Pierre. This breed was developed on the Johnson farms in San Pierre, Indiana, from a foundation cross of Canadian Berkshire and Chester White. The pigs are black and white in color. The head is rather medium in length, and the ear is carried erect. This breed is somewhat shorter than some other breeds yet produces carcasses that are meaty, with good-sized loins and hams.

Hybrid hogs. As used with regard to swine, "hybrid" refers to crosses between inbred lines (line cross) which may be from different breeds (line crossbred). Hybrid is also used by some to include breed crosses. The purpose of such crosses is to take advantage of hybrid vigor in commercial production.

Many other new breeds are being developed from inbred lines. They are being developed specifically for the purpose of using cross-breeding programs for commercial livestock production. Further selection has been directed mainly for some important economic characteristics. These inbred lines are more highly purified than the standard breeds.

Other breeds of swine in the United States. The breeds discussed are those of the greatest economic consequences at the present time. However, many other breeds exist, and in some localities some of the so-called "minor breeds" predominate. None of them are raised very widely in the United States. The more common of these lesser known breeds are: the Kentucky Red Berkshire, the Mulefoot, the Large Black, the Cheshire, the Victoria, the Essex, the Small and Middle Yorkshire, the Landrace, the Sapphire, and still others.

Swine record associations. The active record associations are listed on page 351.

Swine breed publications. Listed below are the names, place of publication, and editors of the current swine publications.

American Hampshire Herdsman Peoria, Illinois	Hereford Swine Journal Chariton, Iowa
The Berkshire News Springfield, Illinois	OIC News Goshen, Indiana
The Chester White Journal Rochester, Indiana	The Spotted Poland-China Bulletin Indianapolis, Indiana
The Duroc News Peoria, Illinois	The Tamworth News Lacona, Iowa
The Yorkshire Journal Lafayette, Indiana	The Poland China World Galesburg, Illinois

SUGGESTIONS FOR FURTHER STUDY

1. Make a study of the breeds of hogs in your locality. Determine the breeding methods used by commercial hog producers in your area. Are they using purebred, crossbreds, or grades?
2. Visit a purebred breeder in your section and arrange to place some classes of breeding sows and boars.
3. Visit the local stockyards or a packing plant in your district and notice the different breeds in the market hogs. Also make an estimate of the proportion of the market hog that are grades, purebred, and crossbred.
4. Write to the swine publications and secure sample copies.

REFERENCES

- BRIGGS, HILTON M. *Modern Breeds of Livestock*. The Macmillan Co., New York
- DAVIS, JOSEPH R. and HARVEY S. DUNCAN. *History of Poland-China Swine*. Poland-China History Association
- EVANS, B. R. and GEORGE G. EVANS. *The Story of Durocs*. United Duroc Record Association, Peoria, Illinois
- NORDBY, JULIUS E. and W. MALCOLM BEESON. *Livestock Judging Handbook*. The Interstate Printers and Publishers, Danville, Illinois
- SMITH, W. W. *Elements of Livestock Judging, Revised*. J. B. Lippincott, Chicago
- SMITH, W. W. *Pork Production*. The Macmillan Co., New York
- United States Department of Agriculture:
Breeds of Swine. Farmers' Bulletin
Influence of Type on Production Efficiency. Circular 698
Results of Swine Breeding. Research Circular 916
- VAUGHAN, H. W. *Breeds of Livestock in America*. College Book Co. Columbus, Ohio

CHAPTER 5

Breeding Stock Selection

SELECTING BOARS or sows for the breeding herd can be done on the basis of conformation, pedigree, or performance. Commonly these are all considered in deciding what should be added to the herd, and what should be culled. It is obvious that performance would be the best to use but such information is not always available, therefore, we consider the pedigree and the performance of the individual's close relatives. Finally too, the conformation of individuality of the animal in question is considered.

If we are to select a bred gilt for example we give attention to the following points:

1. The performance can be judged only by what she has done, which would be her rate of gain. Also the weight at weaning time of the litter would be useful. The production record of the first litter of the sow will determine whether or not she is to be kept for a second litter.

2. The pedigree—if we know something about the sire and dam—it would be helpful in predicting probable production of a gilt.

3. Production of close relatives also may be helpful. How did the preceding crop by the same sire and dam or full brothers and sisters perform? Seldom is such information available. The performance of less closely related individuals may also be helpful.

4. The individuality of the gilt would also be indicative of

her production. This is covered more in detail in the selection of the individual.

If we are to use selection to the best advantage we should understand what is required of a brood sow which is outlined in the next section.

The brood sow requirements. In order to be profitable as a brood sow it is necessary for a sow to:

1. Produce and raise a large number of pigs.
2. Yield a supply of milk to start the pigs and have a heavy litter at weaning time.
3. Impart to the pigs a fast-growing influence so that they will make rapid and economical gains.
4. Impart to the pigs those qualities which are highly desirable in market hogs.

If the sow is purebred she must also meet the requirements for breed type as given in Chapter 4.

The herd boar requirements. The boar contributes one half of the inheritance to the pigs he sires. Often we hear the saying that boar is one half the herd which is literally true since he passes on one half of the genes (or hereditary material) to the pigs he sires. Therefore the boar, in addition to a sure breeder, should transmit the qualities desired in a good productive herd.

Difference between judging market hogs and breeding hogs. Market hog classes, are placed according to their perfection as a profitable market animal, whereas the breeding hogs are selected for the purpose of reproducing market stock. A sow, for example, may be sold as a packing sow or she may be retained as a brood sow. If retained as a brood sow, feminine qualities, breeding qualities, conformance to type, constitution, size, quality, maturity, feet and legs, and other points determine her value; but if to be sold on the market, mainly weight, fatness, quality, and trimness establish the value.

Parts of the sow. Table 2 on page 101 gives the scale of points for a breeding sow. A figure on page 50 shows the parts of a sow and an evaluation of the parts as suggested for evaluating a breeding gilt. The parts are somewhat different from those suggested for the market hog and, as the student will note,

there is a great difference between the relative value for each part.

Age as a factor in breeding stock selection. Most hog producers are willing to rely upon younger stock for the breeding herd. This has certain advantages. Less feed for maintenance and higher sale value after the breeding season are the reasons favoring the young sow herd. In favor of the older sow herd, are greater size of the new-born pigs, larger litters farrowed and raised, and greater dependability in production. Gilts may not be as certain as producers, as sows retained, because of their records. Litter weights at weaning time help to identify the good producing sows in the herd. Production may be affected by conditions other than the ability of the sow. It is therefore evident that two litters is a more accurate measure than one. Many successful hog raisers keep a sow until she proves less productive than the average of the herd, which of course stresses the need for accurate herd records. In production contests most of the great records have been made with sow herds of some age.

What age of breeding stock should be purchased? When starting the herd the grower must choose from stock available. Most breeders offer a far greater number of young boars and bred gilts at their sales. In fact, a breeder having several auction sales per year will have the following during a year: a fall sale, probably in September or October, featuring mainly his spring crop of boar pigs and some spring gilts; a winter sale in January or February in which the offering is made up chiefly of bred gilts of last spring's farrow. If the breeder has a large business, two winter sales are held, and occasionally a late-summer-bred sow sale is held. At auction sales young animals make up most of the offering, and the beginner must make his selections accordingly. Older sows or boars offered in auction or private sales may not be a wise purchase, unless these have definitely proved their ability. Less risk is involved in the purchase of tried sows and boars of established reputations in the breeding herds. The progeny test is a very reliable index to breeding ability.

Swine production testing. Various methods have been used to identify the most productive boars and sows. For some time we have been trying these different methods for evaluating the

efficiency of breeding stock to a basis for selection. Selections on the basis of external appearance has been responsible for considerable improvement in swine. However, to know definitely about productive ability it is necessary to have some facts to distinguish between desirable and undesirable animals. The dairyman has used effectively the weighing of the milk from individual cows and the testing of that milk for butter fat, as a measure of production. On that basis the dairyman has culled the unproductive and retained the productive ones in the herd.

Hog men have made several attempts to start performance testing. As early as 1923 quite a movement was on foot in this country to start a record of performance for swine. The success of swine performance testing in Denmark prompted the first efforts in this direction that were started in this country. The litter testing plan was used, and four representative pigs were fed out from each litter, usually from an age of 65 days to 225 pounds live weight. The five points of economic importance that were tested in this plan were fertility, daily gains, economy of gain, carcass yield, and quality of the product. During the early 30's the use of this plan became limited mainly to agricultural experiment stations.

Later sow testing on farms was started in several places. This was an attempt to identify the productive kind by the hog raisers on their own farms. For some areas widespread use has been made of this effective means of breeding stock evaluation. The Austin Swine Improvement Association at Austin, Minnesota, is a notable example. Such tests have generally been devoid of carcass evaluation and determination of actual feed requirement. However, since gains in weight were recorded in sow testing, some knowledge of economy of gain is obtained since rapid gains are in general economical gains. A pig weighing 20 pounds at weaning time will in most instances, gain slower in the subsequent feeding period than one weighing 30 pounds at weaning time. Pigs heavy at weaning time, will gain fast during the post-suckling period.

Production testing purebreds. Purebred breeders have shown their progress by establishing an all-bred production-testing program. The National Association of Swine Records has formu-

lated a uniform plan which is based upon the following requirements:

1. Farrowing reports. Farrowing reports on nominated litters must be witnessed by one disinterested party of unquestionable standing in the community to verify size of litter and ear marking of the litter. This farrowing record should be sent to the association office within five days after the farrowing date.

2. Fifty-six-day weighing reports. All nominated litters are to be weighed between 51 and 61 days of age and reported to the breed record association office within three days after pigs are weighed. All litterweights will then be calculated, according to the Iowa State College system, to a uniform 56-day basis (56 days after farrowing date). This 56-day weighing must be witnessed by one official, other than the owner of the litter, such as a county agent, assistant county agent, 4-H Club agent, vocational agriculture instructor or supervisor, college livestock extension specialist, cow tester, director or representative of the respective breed record association, or by some other disinterested party designated and endorsed by, previous to the weighing, one of the aforementioned officials. It shall be the duty of the official witness to check the accuracy of the scales used for the weighing. See Chapter 8 where weights at weaning time and factors for the correction of pig weights to a 56-day age basis are given.

3. Qualifying litters. A production registry qualifying litter shall be as follows: (1) for sows (over 15 months of age at farrowing time)—to raise without the aid of a nurse sow, eight or more pigs to an official 56-day litterweight of at least 320 pounds; (2) for gilts (15 months of age or younger at farrowing time)—to raise, without the aid of a nurse sow, eight or more pigs to a 56-day litterweight of at least 275 pounds.

4. Qualifying sows. Sows will be officially admitted in the respective breed association production registry after having raised two qualifying litters. However, recognition for the first qualifying litter of any sow can be indicated on pedigree certificates where her name appears by affixing a star to her registry number. Production registry sows will be classified according to

the number of qualifying litters raised, such as two-star, three-star, etc.

5. *Qualifying boars.* Boars will be officially admitted in the respective breed association production registry when they have sired five 2-star daughters, not more than two of which are full sisters in blood, or, when they have sired 15 one-star daughters, not more than ten of which are full sisters in blood, or, when they have sired an equivalent combination of one- and two-star daughters. (*Note:* In compiling this equivalent combination each one-star daughter would be counted as *one* and each two-star daughter as *three*, the required total for the combination being 15.)

By following the above rules we can evaluate our swine breeding stock. Beyond that, progressive hog men will look to records made by litters, in selecting replacements for the breeding herd. Why take a chance on an untested boar? That which has been accomplished by selection based on production testing may be reduced by one half by a new boar. So boars from fast gaining litters will be in demand among those increasing the productivity of their herds.

Brood sow testing is not a panacea. Other aspects of successful hog raising are not to be neglected in the quest for heavy litters. In fact without proper feeding and management, sanitation, and disease control, it is impossible to have heavy litters. Breed type too has a definite value and is not to be wholly disregarded in sow testing. Also, adherence to the proper type is a necessity. We have found the big and small types wanting in many respects, while the intermediate type best suits all conditions. This newly adopted test is another aid in raising better hogs.

In recent years the uniform standards of the breed associations for production registry have been altered by several of the breeds. A number of the breeds now use 35-day weights and some use weights at younger ages, 21 and 28 days. Further, more emphasis is being given to the carcasses. The probing at the back-fat is now used by some in breeding stock selection, as the depth of back-fat is in turn a measure of leanness.

Certified meat type. Most of the breeds are now making attempts to identify superior strains which meet certain carcass

requirements in addition to productive standards. In some cases this has taken the form of certification; thus we have certified litters, sires, and matings. The measures are made on the carcasses of at least two pigs in a litter, and if they meet the standards the litter is certified. In the Hampshire breed two pigs from a litter of eight weaned pigs must meet the following standards:

TABLE 2. CERTIFIED LITTER CARCASS STANDARDS

WEIGHT	LOIN AREA (MINIMUM)	LENGTH (MINIMUM AND MAXIMUM) INCHES	BACK-FAT THICKNESS (MINIMUM AND MAXIMUM) INCHES
180 to 199 lbs.....	3.5 sq. in.	28.5 to 32.0	1 to 1.6
200 to 214 lbs....	3.75 sq. in.	29 to 32.5	1 to 1.65
215 to 230 lbs.....	4. sq. in.	29.5 to 33	1 to 1.7

(a) Pigs to be delivered to co-operating slaughter station at weight between 180 and 230 lbs. Weight to be off truck weight. Must be barrows or gilts.

(b) Each pig to be tattooed when weighed off truck.

(c) Loin area to be calculated by means of planimeter from tracings of loin eye made on parchment paper.

(d) Loin to be broken at 10th rib.

(e) Carcass length to be calculated from front of first rib where it joins vertebra to front of aitch bone.

(f) Fat-back to be average of three measurements taken:

(1) Opposite first rib.

(2) Opposite last rib.

(3) Opposite last lumbar vertebra.

Measure actual fat-back thickness to outside of skin and at right angle to back.

A sire is certified when he sires five litters that qualify as certified litters, but the litters must be out of five different sows, not more than two of which are full sisters or dam and daughter. Certified matings are from the repeat matings of boars and sows that have produced a certified litter.

Time of culling nonproductive sows. The alert herd manager is continually culling the breeding herd. Sows that fail to settle are sold soon after they have been identified. The best time to cull the sow herd is when they are weaning their litters. Sows that have raised large litters of even-sized strong pigs are to be kept. Sows that have raised poorer than average litters are to be fattened and sold. Mean sows, cripples, poor milkers, and those raising inferior pigs are to be sold.

Major points in breeding stock selection. In addition to the age and the breed there are many other points which merit careful consideration before a selection is made. Assuming that the question of age has been definitely settled by the buyer and that the boar or sow has met the standard set forth by the breed record as regards breed characteristics, growers should study the individual, keeping in mind the following salient points. No attempt has been made to evaluate these points, for if the animal is notably deficient in any of these particulars, it would constitute a disqualification. These may be grouped under the two general headings: (1) selection of the individual; (2) other factors influencing selection.

SELECTION OF THE INDIVIDUAL

Ancestry or parentage. If a breeder is making selections at an auction sale, time should be spent in studying the pedigrees of the offering. Selections can be made on this basis before attending the sale, thus reducing the confusion in correlating pedigree to the individual on all in the sale. Mark the catalog indicating your preference in the matter of ancestry indicating at least three of four groups. "Preferred," "acceptable," "doubtful," and "not acceptable" are suggested as suitable terms for this designation. If the transaction is a private sale, copies of the pedigree should be made and studied.

What is desirable in a pedigree? Time-tried strains are certainly to be desired. Noted individuals both from breeding and show ring close up in the ancestry should be preferred. Performance tests by the preceding generations must likewise receive attention; and, lastly, being from a large litter is always a strong recommendation. A study of the individuality of the sire and dam will assist him in predicting the outcome of a young pig. Therefore, see the parents if at all possible.

Size. Large size in breeding hogs is demanded because it is the size which imparts to the offspring the impetus of rapid growth. Rapid growth and economical gains are definitely correlated. It may seem strange to have boars of a weight of 800 to 900 pounds and sows 600 pounds and over to raise 200-pound

pigs. The pigs from such ancestors can be fattened while growing; in fact, these processes go on simultaneously and when the 200 pounds of weight is reached, they probably carry sufficient finish to meet market demands. If the pigs have had full feed and do not have sufficient finish at the 200-pound mark, the parents are probably too large. However, weight is just one measure of size. Breeders more often speak of "growthiness," which is a more definite expression of the desired quality. Boars and sows can be made heavy by loading with extra fat. This is neither profitable nor desirable.

The form of the market pig holds but in part for the breeding hog of the same age. Less finish and its accompanying width, more length of body and legs are sought in the breeding pig. "Stretch" and "length" are terms often used in describing the young pigs in the breeding classes. A word of caution should be thrown out: extremes in this direction fail to qualify in such essential things as fleshing qualities and other points. Likewise, the small, compact kind must also be avoided as they finish at too young an age and lack in growthiness. In other respects the form required for a breeding hog is very nearly identical to that of the market barrow. Strong, evenly arched top lines, smooth sides and shoulders, uniform width, and heavy hams are worthy of most careful consideration.

Quality is demanded in breeding hogs, but not to the point of causing a sacrifice in size, ruggedness, and ample bone development. The retention of good size with a higher degree of quality is the goal for which breeders are striving. Smoothness of form and fleshing, and freedom from creases or wrinkles are demanded in the breeding classes as in fat classes. Trimness of the jowl, underline, and hams is a definite indicator of quality. Smoothness of shoulder is also a point to consider. Boars develop "shields" in the two-year-old form. A great amount of development along this line is generally called a "crusty appearance," which is decidedly objectionable. The hair coat is also an index of quality. Sufficient hair growth for protection is required, but heavy, bristly, wavy, or curly coats of hair are objectionable. Swirls or rosettes in the hair are objectionable when along the top line. This is a peculiarity in that the hair growth

radiates from one point. Although not distinguishable in the hog carcass, it is objected to by breeders, and in the show ring is usually regarded as a disqualification. Failure to discourage the use of swine with swirls would increase their presence.

Feeding qualities. All breeding hogs, regardless of age, should carry the quality associated with feeding capacity. In the terms of the farmer they should exhibit the qualities of a "good feeder." The head is an indicator of feeding ability as is the length, depth, and width of the body. Capacity to handle feeds is increased by body size and the general difference between a fast gainer and one slow in making gains is the capacity for the handling of feed.

Fleshing qualities and condition. Eventually the worth of a hog depends upon the pork produced. Breeders may well heed the time-worn statement that the end of the hog is the pork barrel. Great fatness is not wanted in a breeding class; in fact, in junior pig classes but a small amount of fatness is tolerated. Measuring the fat-back on the live animal by probing is a measure of meatiness of the individual. It should be measured on a full-feed pig. Fleshing, that is, leanness, as shown by wide, plump hams, ample width of back and loins, is highly desirable.

Maturity is often a matter of dispute. Some hold that the compact, low-set type is the early-maturing kind. The stockman generally uses the term "early maturing" as meaning finished for market at a young age. This involves rapid growth with sufficient finish to suit the pork packer. Small types get to market weights at older ages and for that reason are not usually considered early maturing. Also, when the small-type kinds are finished the lard yield is too heavy to bring the highest market price.

Condition and vigor. The hog is very often infected with parasites and disease. Strict sanitary measures are necessary to control these conditions in sections where hogs have been raised for many years. Select only those with strong constitutions, as shown by a deep, wide chest, well-filled back of the shoulder, and a body of good depth. An active, animated appearance indicates strong vigor. Active sows are good grazers and also take good care of their pigs in the farrowing. A capacious middle and good appetite indicate a strong constitution. A bright eye, a broad

head, and a wide snout are usually associated with good constitution and vigor.

Health is closely linked with constitution and vigor in the hog. The absence of unusual symptoms such as a cough, a rough hair coat, a poor appetite (off feed), or a thin condition assures one that the animal considered is most probably of good health. A listless, dejected appearance of the sale hogs should be a caution to the buyer. Swine influenza, commonly called "hog flu," is rather common in pigs in the fall and especially at the hog shows. While not often a fatal disease, it may affect future usefulness. It is the best plan to buy those which are sick on the basis of delivery to be made on complete recovery of the pig. Discretion should be used in buying pigs that are not in the best of health. The loss accruing from such a purchase may not be confined to the one animal. Care should be exercised with regard to abortion disease and tuberculosis. It is also wise to guard against such things as lung worms, common intestinal worms, and hog mange, all of which are rather common.

Pigs raised under a system of swine sanitation, by breeders who have exercised care in disease control, and that show no visible manifestations of the presence of disease should have decided preference.

Feet and legs are of greater importance in breeding hogs than market hogs. Short legs are typical of the short, compact type. Medium to long legs are typical of our desired present-day type. More ruggedness is demanded in the feet and legs of the boar. Medium to large-size bone is desired, and along with that a clean appearance is demanded. Hog men have of late introduced a new term, "soundness." This term was, no doubt, borrowed from the horseman's vocabulary, where it has long been used to denote the absence of unsoundness which, it will be recalled, impairs the usefulness of the horse. No definite limitations have been made on this term when used in describing hogs. However, it usually includes more than feet and legs, and to most it signifies freedom from any defects of importance. A pig with poor vision, irregular gait, or crooked hock would not be considered sound.

The ideal set of the legs is that preferred in the draft horse,



This sow has inverted teats or smooth underline. A sow should have at least 10 teats of uniform size and even placing.

straight and under the four corners. However, hog breeders tolerate less slope of pastern. The pasterns should be short and strong, and the foot should be of good size and without much distance between the toes.

Breeding qualities or sex characters. Masculinity is demanded in the sire or boar, while femininity is demanded in the dam or sow. These are the qualities which are termed the secondary sexual characteristics and are shown in the heaviness of the front quarters in the boar, especially by the large head and heavier neck and shoulders. A normal development of the sex organs should be evident. A masculine boar usually excels in prepotency and sureness as a breeder.

A good brood sow successfully suckles a large litter. This requires an ample mammary system. At least ten teats of uniform size and evenly placed should be required of the sow. Inverted nipples may develop satisfactorily as the sow advances in pregnancy, but the safest plan is to eliminate those with questionable teats, as inverted teats have a hereditary basis. It has been found that sows with blind teats or inverted nipples farrow as large litters as those with normal teats. However there is apparently a slight advantage in favor of the pigs from sows with normal

udder in weaning weight, and there is a big difference in the number of pigs raised. In a Missouri investigation it was found that inverted nipples could usually be detected at birth. The error in predicting was but 5 per cent on 40 gilts, and none of the teats normal at birth were inverted at farrowing time. With boars too, attention is given to the teats. At least ten rudimentary teats are desirable. Further with boars the well-developed testicles even in size and normally descended into the scrotum are desired. The mammary system, together with general refinement, and a lack of heavy front quarters, is regarded as an indication of maternal qualities in the sow. Such sows are the most regular breeders and best mothers.

Disposition. Inasmuch as the boar and the sow must be handled a great deal, it is highly important to have in both a good disposition. Disposition is likewise correlated with rapidity of gain. Lymphatic animals make more rapid gains. A boar should have a mild disposition yet be active. Avoid irritable boars as they are unsafe. A sow with a quiet, tractable disposition will be more likely to prove herself as a pig raiser.

OTHER FACTORS INFLUENCING SELECTION

1. **Date of farrow.** In the study of a sale catalog the stockman should note the farrowing date. If anticipating showing in the coming year, this is of especial importance. It may also be a factor in making herd additions as it may fit into the plan of management to have all of about equal age. This is also a factor in boar selection, for unless a breeding crate is available a large boar cannot be used on young sows.

2. **Date of breeding.** In sow selection note the date, page of breeding and calculate the date of farrowing. See gestation table. This is necessary in planning for show classifications and herd-management plans.

3. **The service boar.** This is highly important in choosing a bred sow as this boar represents the top half of the pedigree of the pigs farrowed. Note the suggestions under ancestry of parentage.

4. **Reliability of the breeder.** Buy only from those who have an established reputation for fair dealings. Note also the guar-

antee in the sale catalog if buying at an auction. If a private sale, secure a statement from the owner as to the limits of his guarantee and other features of the transaction such as pedigree, etc. If purchases are made from a man of high standing in the community, the possibilities of adequate adjustment, if need be, are infinitely greater.

5. Shipping. The transportation may involve much expense and inconvenience. If trucking is not feasible, express shipment is generally indicated. Before buying, determine the cost of shipping and also the length of the trip.

6. Price. Unless the breeder is experienced, counsel as regards the amount to spend and relative values is highly desirable. It is inadvisable to start with poor individuals. It is also foolish to make such additions to the herd. All additions should represent a forward step in herd improvement.

7. Other factors. There are also many other items to be considered in making purchases of pitrebred hogs, such as method of financing, inducements offered by breeders, standing of the breeder, etc. Stockmen should welcome the suggestions of those with experience when debating the question of where to buy.

Auction or Private Sale. At auction sales stockmen may be able to buy the animal for less money in spite of the "sale cost." This is due to the volume of sales possible and the concentration of the sale into one short period. There are also advantages of private sales from the standpoint of the buyer. A shrewd buyer may be able to buy animals for less than at an auction, and greater time for deliberation is available. He should attend the auction-sales to make the acquaintance of breeders and to study individuals, prices, etc. Whether to buy at a sale or privately depends entirely upon values.

SUGGESTIONS FOR FURTHER STUDY

1. Visit a local or district swine show and place some classes of market and breeding hogs.
2. Attend a purebred hog sale in your locality. Keep a record of the prices paid and determine the average price for the sale.
3. Make a collection of sale catalogs from purebred swine breeders and make a study of the pedigrees of the sale offering.

4. Arrange to do some production testing with a swine breeding herd. Sow testing is an effective means of increasing the production of a herd.

5. Study the production records from several herds and decide which sows should be culled.

REFERENCES

NORDBY, JULIUS E. and W. MALCOLM BEESON, *Livestock Judging Handbook*. The Interstate Printers and Publishers, Danville, Illinois

SMITH, W. W. *Elements of Livestock Judging, Revised*. J. B. Lippincott Co., Chicago

CHAPTER 6

The Breeding Season

IN GENERAL there are two main breeding seasons; the fall breeding for the spring pig crop and the spring breeding for the fall pig crop.

If good size litters of healthy pigs are to be raised it is necessary to have proper feeding and management throughout the year. The breeding season is however one of the important periods. Lack of success in hog raising in many cases may be attributed to neglect of the herd during the breeding season.

The need for proper care in the breeding season. Good feeding and management practices are reflected in the resultant crop of pigs. We must have breeding stock which has the capacity to produce, and the good feeding and management must be extended through the gestation and suckling periods to have a good pig crop at weaning time.

It has been shown that the hog raiser can markedly influence the performance by the excellency of the feeding and management. This is shown in the crop by:

1. The number of pigs farrowed; litter size.
2. The proportion of pigs born dead or still-born pigs.
3. The uniformity of the pigs within the litter.
4. The size of the new-born pigs.
5. The strength and vigor of the pigs. This is highly related to the survival of the pigs or livability.

Good feeding and management will result in large uniform litters, few still-born pigs, and pigs with sufficient size and vigor



Here is a breeding herd of Hampshire gilts. These gilts are in good condition for the breeding season.

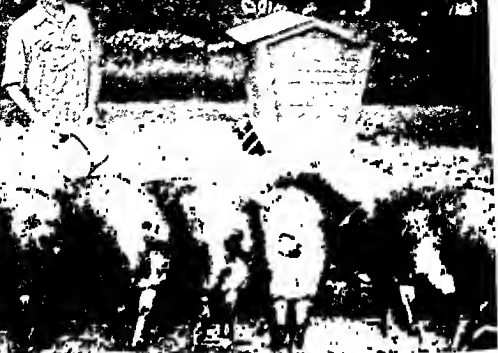
to survive. If the litter size is small or the death rate high, the feeding and management should be carefully checked for a deficiency.

It should be pointed out that the boar can effect the litters. If he is infertile, the sows will not settle. If he is partially infertile the litter size may not be up to the possible prolificacy of the sows. Handling of the boar may influence the quality or the potency of the semen that he produces.

Nutritive allowances recommended for sows. In the appendix there is included a statement of the nutrient requirement for all classes of swine as recommended by the National Research Council.

Commonly in practice the protein level is used to check the adequacy of ration. This is satisfactory if the consumption is high enough. It is suggested for sows that the protein level be approximately as given in Table 3.

Flushing the sow herd. Sows in a high plane of nutrition will promptly come into heat, will settle with fewer services to the boar, and will be more productive at farrowing time. The practice of improving the ration in amount or quality just before breeding is known as "flushing." It was first established as



Hand feeding of the breeding herd is shown here. Good feeding and management can influence the pig crop.

TABLE 3. SUGGESTED PROTEIN LEVELS OF RATIONS FOR SOWS

CLASS	IN DRY-LOT, PER CENT	ON PASTURE, PER CENT
Bred Sow	14-15	11-12
Suckling Sows	15-16	12-13
Finishing for Market	12-13	9-10

The above table is based on the total (not digestible) protein in the ration fed.

of sheep-
ks before
has been
well fed on a good ration, there may be no advantage in "flush-
ing." The sows should not be overfat. This is as objectionable
as the other extreme, especially if the fatness has been obtained
on heavy corn feeding. Sows may be kept from getting too fat
by the use of a balanced ration and including some bulky feeds
in it. Proper amount of exercise too is not to be neglected.
The ration for flushing. If the ration fed previously has been
properly balanced and has contained ample amounts of all of



This is a Hampshire herd of breeding gilts in good breeding condition. Proper attention of the herd will increase the productivity.



This breeding herd is on pasture. There are many advantages in making the maximum use of pasture for the breeding herd.

the nutritive factors, the change at the flushing period is in amount. Usually the previous ration is deficient in the amount and quality of protein, and it is often lacking in required mineral matter and vitamins. If the ration has been rather wide—high in carbohydrates and fat to protein—it would be advisable to make it narrower, that is, increase the relative percentage of protein material. Two to three pounds of feed should be allowed per 100 pounds of live weight for flushing. A growing sow obviously requires the upper limit, whereas a mature sow in good flesh may require even less than two pounds of feed for 100 pounds of weight. Such ration allowances as these are often called 2 or 3 per cent rations, this being in accordance with the feed given per 100 pounds live weight.

To feed on pasture is advantageous, as there is less danger of a nutritional deficiency when forage is allowed. In addition to the forage, a ration consisting of corn plus some oats and a supplemental feed and a good mineral mixture would be very satisfactory. About one pound of oats, three-fourths of a pound of supplemental feed and enough corn or other basal concentrate to make up the 2 or 3 per cent ration would in most cases be ample. This ration is suggested for corn-belt conditions and is one of proven worth. However, there are many feed combinations which give excellent results. Care should be taken in feed selection for this ration because a faulty ration will show up in the pig crop. Definite amounts for feeds are given merely as approximate averages. Judgment should be used in arriving at the amount to feed.

Other rations for the sow herd before breeding. Many different feeds may be used in the ration for the prospective brood sow and there are also many satisfactory mixes or blends of the same feeds. The following feed combinations are listed merely as approximate guides:

	<i>Per cent</i>		<i>Per cent</i>		<i>Per cent</i>
1. Corn.	50	2. Corn	70	3. Corn or other	
Oats	29	Wheat mid-		grain.....	60
Meat scraps or		dlings ...	9	Oats.....	25
tankage	2	Meat scraps or		Good supple-	
Soybean oil meal	4	tankage	2	mental mix-	
Alfalfa hay or		Soybean oil meal	4	ture 35%	
meal	15	Alfalfa hay or		protein	15
		meal	15		

A mineral mixture should be self-fed as well. The alfalfa hay or meal is to be omitted when pasture or silage is included in the ration. It should be pointed out again that growing gilts need a better ration than older sows.

Substitutions in rations. Certain substitutions are permitted in the above rations with good results. This may be replaced partially or completely by such other basal feeds as barley, wheat, grain sorghums, emmer, hominy, and others. If oats, rye, or molasses are to be used, partial replacement is suggested.

The supplemental mixture suggested should be a high protein mixture. The following are suggested as being constituents for this mixture: tankage, soybean meal, alfalfa meal, and fish meal. Most of these are used to the best advantage in combinations, and these combination mixtures may include such feeds as soybean oil meal, linseed meal, cottonseed meal, gluten meal, and middlings, and in addition carry vitamin, mineral, and anti-biotic fortification.

Milk by-products—that is, skim milk and buttermilk, when available—are valuable additions to the ration for both the sows and boars of the breeding herd in the fall. This may be used as the entire substitute for the protein mixture or to partially replace the same. It is usually considered that about ten pounds of skim milk or buttermilk is equal in supplemental value to one pound of tankage. From six to ten pounds of skim milk or buttermilk are needed per sow or boar during the breeding season, depending upon the previous condition of the animals.

Pastures for the breeding herd in the fall. Pasturage is desirable in the ration, and a growthy leguminous forage is preferred. In event of the absence of suitable forage, alfalfa hay should be fed, or alfalfa meal may be included in the supplement. Pasture is generally available during both breeding seasons, and should be used. When the forage wanes, add alfalfa meal or hay to the ration.

Age of the boar affects feeding and management. Older boars, like older sows, should be kept on a maximum of low-priced feeds. Pasture should be used to the greatest degree, while home-grown grains and protein supplements should be fed sparingly. Minerals should be allowed in free will.

A young boar, on the other hand, needs vastly more feed for a unit of weight. Feed combinations which are growth-promoting are to be used during the breeding as well as before and after breeding.

Exercise for the boar. A pig on dry lot with a self-feeder, if a balanced ration is allowed, will take a minimum of exercise. He soon becomes fat and inactive. This is what must be guarded against in the management of the boar. If necessary, drive him with a whip each day. However, if range is allowed and the feeding place moved, more exercise is encouraged. This likewise keeps the boar lot in a cleaner condition because of greater area and moving the feed trough. Two boars may be kept together most of the time, but they should be separated during the breeding season as they will fight at that time of the year.

The herd boar should receive proper care and attention. Too often a boar in yearling or aged form is confined to a small pen in which filth abounds and exercise is discouraged. A sire is half of the herd—at least, he represents 50 per cent of the crop of pigs which he sires. This indicates his importance and emphasizes the need for proper care and feeding. Young boars are less difficult to handle than older ones and the feeding is not greatly different from that of feeding a young sow. An active boar with breeding capacity is desired and the feeding and care should be such as would perpetuate this condition.

Kind and amount of feed to use. A herd boar is usually maintained in a rather thin condition. By all means he should be kept from getting over-fat, slow, and inactive. This is best accomplished by limited feeding of a good ration, by allowing range, and by encouraging exercise. As the breeding season approaches, the ration should be narrowed, as was the case with the sow herd; that is, it should contain a greater amount of protein material, and the amount of feed must also be increased. During the season of breeding, the boar needs nutrient material in excess of maintenance requirements to meet his needs. Young boars to be used for the first time for the fall breeding should be well grown and well developed for their age. Heavier feeding is needed during the breeding season. The growth need is to be met as well as the extra demand for breeding if uninter-

rupted growth is desired. The actual amount of feed to use depends entirely upon the individual. The boar is generally fed and kept separately. Self-feeding, then, is of no advantage and may cause too heavy feeding. The size, condition, and appetite determine the amounts of a well-balanced ration to be hand fed twice daily. Corn and oats in equal parts supplemented in limited quantities with a good protein-rich feed, about three-fourths to one pound per day, with minerals self-fed, and pasture will take care of the boar's needs.

Boars that rant. Some boars pace back and forth along the fence during the breeding season. This is called "ranting" and it may be rather difficult to control. It is usually suggested that a barrow or a bred sow be kept along with the boar to at least partially prevent the ranting of the boar. Separation at some distance from the sows is also an effective cure against ranting.

Separation of boars and sows. It is usually regarded advisable to separate the boar from the breeding herd. More sows can be mated to one boar if they are kept separate and each sow is bred once or twice when in heat. It is also safer to confine the boar to a small lot rather than have him ranging with the sow herd. Most boars are quite gentle to handle when not around another boar, and boars kept alone and handled regularly are usually quite docile. When the herd boar ranges with the sows it is impossible to have an accurate breeding record. Consequently, an accurate estimate of the farrowing date is not available.

Age to separate boars and sows. Gilts that are heavily fed on a good ration arrive at sexual maturity at a young age. Between four to five months of age some of the well-developed gilts come in heat. Separation prior to this time is advisable. Most pigs are kept together until older ages are reached and this is not objectionable, but the group of pigs should be carefully watched so that the sexes may be separated when necessary.

Age to breed. The age to breed is dependent upon the size and development of the young sow or gilt. Many gilts are bred to farrow their first litter of pigs when they are 12 months of age. By following the practice of breeding the gilts when they

are quite young one can reduce the cost of producing pigs, provided the young gilts are as good producers as the older gilts or sows. It is quite generally believed that gilts farrowing litters of pigs when much under one year of age will be stunted in ultimate size and will produce and raise a small litter. Their suckling ability is also regarded as being impaired. Gilts that are well grown, that weigh at least 200 pounds, and are eight months of age can be bred with excellent results under most conditions. Prolonged sucking rather than pregnancy affects the growth and size. Long suckling periods may reduce the prolificacy of sows. When a litter of pigs is weaned from a sow and heavy feeding continues she will come in heat in a few days. About three days after farrowing a litter of pigs a sow will normally come in heat. Breeding at this time is inadvisable as but few sows will conceive.

Gilts that are to be shown are often kept open or bred later in the season. Regularity of breeding is often influenced by long periods of barrenness and postponement of early breeding. Senior yearling sows that have not raised litters of pigs are commonly disqualified at swine shows, and junior yearling must have farrowed a litter of pigs or be carrying a litter.

Litters from old sows and young boars. The litters from older sows are at least one pig larger than those from gilts. Sows between the ages of two and four years are more prolific and if they make up a large percentage of the sow herd, fewer would be needed to produce the pig crop provided they would raise a large percentage of pigs farrowed. Progressive herd improvement is likewise far more easily accomplished by keeping the breeding herd intact as long as possible. When a sow falls down in prolificacy or suckling ability, she should make way for a gilt of good individuality from a productive family.

Age of boar to use. Most farmers prefer to use a young boar because the young boar is handled with greater ease and is more active in mating. It is a common practice in market-hog production to castrate the boar after he has completed the season and then market him. Boars can be used for breeding at six months of age if properly handled. However, most boar pigs are at least eight months of age before the breeding season be-

gins. As is the case with gilts, if the boar is well developed he can be used moderately at eight months of age.

It is usually recommended that the boar pig be mated with 15 to 20 sows; and when a yearling or older boar is used, 40 sows may be included in the season of breeding. Many noted boar pigs have been mated to more than 20 sows without apparent injury to the future development and usefulness of the pig. In the hands of an experienced breeder the number has been more than doubled. It has often been said that the age and vigor of the male has no influence upon fertility. However, recent investigations have indicated that the herd boar may have an influence upon litter size.

Number of services. When the sow herd is small the boar is permitted to run with the herd and the sows are served many times when they are in heat. If the boar is kept from the herd more than one service may result in increased litter size. It has been shown that sows can be bred too early or too late in the heat period for maximum conceptions. Best results are obtained by breeding the latter part of the period while sows are in heat. Sows are in heat and will accept the boar for from 40 to 60 hours. Gilts are in heat a shorter time than older sows. Therefore, when the boar is kept from the herd breeding more than once with a 12- to 24-hour period between breeding may be advantageous. In a Missouri test the following results were obtained.

TABLE 4. INFLUENCE OF ONE OR TWO SERVICES UPON LITTER SIZE

	NO. BRED	NO. SETTLED	PER CENT SETTLED	LITTER SIZE	PIGS PER GILT
Bred twice during heat	40	36	90	8.2	7.4
Bred once during heat	43	31	72	7.1	5.1

How can a hog raiser take advantage of these findings?

In practice the sow will be bred the first day she will take the boar and each subsequent day thereafter that she will accept the boar; that is for two or three times on following days. Many

successful hog producers are following this plan. A word of caution is in order. Over use of the boar to follow this plan is to be avoided.

Artificial insemination. This is the depositing of the male sperm in the female reproductive tract by artificial means. The practice has been quite successful with cattle. With swine it is still in the experimental stage. There are many problems in the application of the technique with swine which have not been completely solved, as the litter size is usually low with this method. Progress is being made and perhaps before long we will be able to use this practice and maintain litter size.

Breeding sows that have farrowed. Sows can be bred a few days after farrowing but few, if any, sows settle to a service at that time. Investigations have revealed that no sows ovulate immediately after farrowing.

Suckling sows seldom come in heat. At from six to eight weeks after farrowing separation of the pigs from the sows at night will induce heat in three to five days. So if a lot of sows are to be bred as soon as possible after farrowing heavy feeding during suckling is to be followed and the pigs separated from the sows at night when they are well started.

Length of gestation period. A gestation table for swine is given on page 121. Of the common farm animals the sow has the shortest gestation period. It is commonly remembered as three months, three weeks, and three days or as 114 days. Most gestation tables are based upon 112 days. This, no doubt has some merit but it is shorter than the average swine pregnancy period, which is between 114 and 115 days. Older sows apparently have a slightly longer gestation period than younger sows. The variation in length of period is quite great in 720 litters containing 5,840 pigs studied at the Illinois Station. The range was from 98 to 124 days. This study further reveals an average pregnancy period length of 114.58 days and that 93.6 per cent of the litters were farrowed between the 111th and 119th days and 73.8 per cent between the 113th and 117th days.

Time of breeding. The natural breeding season for swine is in the spring and fall. April is the heavy spring month, which, of course, marks December as the month of heaviest breeding.

TABLE 5. GESTATION

DATE BRED	DUE TO FARROW	DATE BRED	DUE TO FARROW	DATE BRED	DUE TO FARROW	DATE BRED	DUE TO FARROW	DATE BRED	DUE TO FARROW
Jan. 1	Apr. 22	Mar. 15	July 4	May 27	Sept. 15	Aug. 8	Nov. 27	Oct. 20	Feb. 8
" 2	" 23	" 16	" 5	" 28	" 16	" 9	" 28	" 21	" 9
" 3	" 24	" 17	" 6	" 29	" 17	" 10	" 29	" 22	" 10
" 4	" 25	" 18	" 7	" 30	" 18	" 11	" 30	" 23	" 11
" 5	" 26	" 19	" 8	" 31	" 19	" 12	Dec. 1	" 24	" 12
" 6	" 27	" 20	" 9	June 1	" 20	" 13	" 2	" 25	" 13
" 7	" 28	" 21	" 10	" 2	" 21	" 14	" 3	" 26	" 14
" 8	" 29	" 22	" 11	" 3	" 22	" 15	" 4	" 27	" 15
" 9	" 30	" 23	" 12	" 4	" 23	" 16	" 5	" 28	" 16
" 10	May 1	" 24	" 13	" 5	" 24	" 17	" 6	" 29	" 17
" 11	" 2	" 25	" 14	" 6	" 25	" 18	" 7	" 30	" 18
" 12	" 3	" 26	" 15	" 7	" 26	" 19	" 8	" 31	" 19
" 13	" 4	" 27	" 16	" 8	" 27	" 20	" 9	Nov. 1	" 20
" 14	" 5	" 28	" 17	" 9	" 28	" 21	" 10	" 2	" 21
" 15	" 6	" 29	" 18	" 10	" 29	" 22	" 11	" 3	" 22
" 16	" 7	" 30	" 19	" 11	" 30	" 23	" 12	" 4	" 23
" 17	" 8	" 31	" 20	" 12	Oct 1	" 24	" 13	" 5	" 24
" 18	" 9	Apr. 1	" 21	" 13	" 2	" 25	" 14	" 6	" 25
" 19	" 10	" 2	" 22	" 14	" 3	" 26	" 15	" 7	" 26
" 20	" 11	" 3	" 23	" 15	" 4	" 27	" 16	" 8	" 27
" 21	" 12	" 4	" 24	" 16	" 5	" 28	" 17	" 9	" 28
" 22	" 13	" 5	" 25	" 17	" 6	" 29	" 18	10	Mar. 1
" 23	" 14	" 6	" 26	" 18	" 7	" 30	" 19	" 11	" 2
" 24	" 15	" 7	" 27	" 19	" 8	" 31	" 20	" 12	" 3
" 25	" 16	" 8	" 28	" 20	" 9	Sept. 1	" 21	" 13	" 4
" 26	" 17	" 9	" 29	" 21	" 10	" 2	" 22	" 14	" 5
" 27	" 18	" 10	" 30	" 22	" 11	" 3	" 23	" 15	" 6
" 28	" 19	" 11	" 31	" 23	" 12	" 4	" 24	" 16	" 7
" 29	" 20	" 12	Aug 1	" 24	" 13	" 5	" 25	" 17	" 8
" 30	" 21	" 13	" 2	" 25	" 14	" 6	" 26	" 18	" 9
" 31	" 22	" 14	" 3	" 26	" 15	" 7	" 27	" 19	10
Feb. 1	" 23	" 15	" 4	" 27	" 16	" 8	" 28	" 20	" 11
" 2	" 24	" 16	" 5	" 28	" 17	" 9	" 29	" 21	" 12
" 3	" 25	" 17	" 6	" 29	" 18	" 10	" 30	" 22	" 13
" 4	" 26	" 18	" 7	" 30	" 19	" 11	" 31	" 23	" 14
" 5	" 27	" 19	" 8	July 1	" 20	" 12	Jan 1	" 24	" 15
" 6	" 28	" 20	" 9	" 2	" 21	" 13	" 2	" 25	" 16
" 7	" 29	" 21	" 10	" 3	" 22	" 14	" 3	" 26	" 17
" 8	" 30	" 22	" 11	" 4	" 23	" 15	" 4	" 27	" 18
" 9	" 31	" 23	" 12	" 5	" 24	" 16	" 5	" 28	" 19
" 10	June 1	" 24	" 13	" 6	" 25	" 17	" 6	" 29	" 20
" 11	" 2	" 25	" 14	" 7	" 26	" 18	" 7	" 30	" 21
" 12	" 3	" 26	" 15	" 8	" 27	" 19	" 8	Dec. 1	" 22
" 13	" 4	" 27	" 16	" 9	" 28	" 20	" 9	" 2	" 23
" 14	" 5	" 28	" 17	" 10	" 29	" 21	" 10	" 3	" 24
" 15	" 6	" 29	" 18	" 11	" 30	" 22	" 11	" 4	" 25
" 16	" 7	" 30	" 19	" 12	" 31	" 23	" 12	" 5	" 26
" 17	" 8	May 1	" 20	" 13	Nov. 1	" 24	" 13	" 6	" 27
" 18	" 9	" 2	" 21	" 14	" 2	" 25	" 14	" 7	" 28
" 19	" 10	" 3	" 22	" 15	" 3	" 26	" 15	" 8	" 29
" 20	" 11	" 4	" 23	" 16	" 4	" 27	" 16	" 9	" 30
" 21	" 12	" 5	" 24	" 17	" 5	" 28	" 17	" 10	" 31
" 22	" 13	" 6	" 25	" 18	" 6	" 29	" 18	11	Apr. 1
" 23	" 14	" 7	" 26	" 19	" 7	" 30	" 19	" 12	" 2
" 24	" 15	" 8	" 27	" 20	" 8	Oct 1	" 20	" 13	" 3
" 25	" 16	" 9	" 28	" 21	" 9	" 2	" 21	" 14	" 4
" 26	" 17	" 10	" 29	" 22	" 10	" 3	" 22	" 15	" 5
" 27	" 18	" 11	" 30	" 23	" 11	" 4	" 23	" 16	" 6
" 28	" 19	" 12	" 31	" 24	" 12	" 5	" 24	" 17	" 7
Mar. 1	" 20	" 13	Sept. 1	" 25	" 13	" 6	" 25	" 18	" 8
" 2	" 21	" 14	" 2	" 26	" 14	" 7	" 26	" 19	" 9
" 3	" 22	" 15	" 3	" 27	" 15	" 8	" 27	" 20	" 10
" 4	" 23	" 16	" 4	" 28	" 16	" 9	" 28	" 21	" 11
" 5	" 24	" 17	" 5	" 29	" 17	" 10	" 29	" 22	" 12
" 6	" 25	" 18	" 6	" 30	" 18	" 11	" 30	" 23	" 13
" 7	" 26	" 19	" 7	" 31	" 19	" 12	" 31	" 24	" 14
" 8	" 27	" 20	" 8	Aug 1	" 20	" 13	Feb 1	" 25	" 15
" 9	" 28	" 21	" 9	" 2	" 21	" 14	" 2	" 26	" 16
" 10	" 29	" 22	" 10	" 3	" 22	" 15	" 3	" 27	" 17
" 11	" 30	" 23	" 11	" 4	" 23	" 16	" 4	" 28	" 18
" 12	July 1	" 24	" 12	" 5	" 24	" 17	" 5	" 29	" 19
" 13	" 2	" 25	" 13	" 6	" 25	" 18	" 6	" 30	" 20
" 14	" 3	" 26	" 14	" 7	" 26	" 19	" 7	" 31	" 21

The fall crop is farrowed principally in September from the heavy breeding in the month of May. (See time of farrowing, Chapter 8, page 150.) This shows when the pigs are farrowed. The time of breeding and consequent farrowing time should depend upon buildings and equipment, feed supply, and the market. Early spring pigs require better equipment, and use more of the previous year's crop; but they are usually finished in time for a higher market and they get the maximum usage of forage crops, upon which the most economical gains are usually made. Late spring pigs may fit into the plan of hog raising better than early farrowed pigs when no fall pigs are raised on the farm, or when there is a feed shortage. In the latter situation the pig crop can be fed out with a larger proportion of the current year's crop. Fall pigs are less numerous than spring pigs but they can be equally profitable if there is suitable equipment on the farm. The spring pig crop comes to market mainly in December and January, while the fall pigs are marketed mainly in April and May. This varies considerably from year to year. Not only is the time of farrowing involved but feed supply, pasture, weather, and market conditions are involved.

Time of breeding for purebred pigs. Pigs that are to be shown should be farrowed on or shortly after the base dates, February 1, March 15, and August 1, for show-ring classification by age. Spring pigs farrowed in March are preferred by the breeder for showing because they have an opportunity to develop by the time of the fall shows. The buyer in most cases prefers the larger older pig, as the future development of a well-developed pig can be more accurately foretold than that of a much younger pig. It will be recalled that weight for age is an important consideration in judging breeding hogs. Consequently, the selector of breeding hogs gives preference to large-sized, well-developed, growthy pigs. This is particularly true of boar pigs, and for fall sales, large, well-grown pigs are in demand.

Mating systems. Farmers commonly follow the system of turning the boar in with the sow herd. This is fairly satisfactory for a small-sized herd when the number of sows to be bred is well under the capacity of the boar. This plan involves less time

on the part of the manager, and all of the sows which come in heat are bred. No record is available of the breeding date, which is the greatest drawback to the plan. Yet for market hogs with a small herd this, no doubt, is the most satisfactory plan.

With a large sow herd the other mating system, known as hand coupling, is practiced. This is also the plan practiced in pure-bred herds where accurate breeding records are a necessity. In carrying out this plan the sow herd must be observed carefully each day so that the sow in heat may be separated and bred. Sows in heat usually separate themselves from the remainder of the herd, and if the boar is in the adjoining lot they will be along the fence by the boar lot. These periods of sexual excitement occur every 20 or 21 days if the sow is not bred. If the sow does not settle to the service of the boar there will be a recurrence of heat in about 21 days. This period of the estrus cycle, which is about two or three days, marks the time when the sow will mate with the boar. If two sows are in heat the same day, one may be bred in the morning and the other in the evening. Female germ cells or ova, which have developed in the sow, unite with the germ cells or spermatozoa of the boar to form the embryonic pig. These are called fetuses during pregnancy.

A yearling or mature boar should not breed more than three sows per day and generally they should be limited to two services per day, which should be the limit for a younger boar. If there is much difference in the size of the boar and the sows, a breeding crate will facilitate breeding. A young boar may need assistance in breeding sows but generally most boars are extremely active and will mate promptly with sows in heat. Since some boars are infertile the herd manager should be on the alert for sows coming back in heat about three weeks after they were first bred. Usually less than 5 per cent of boars are infertile and but very few will not mate with sows. Notations in the breeding record should be included, in addition to the sow's name, number, and identification, and also the same data concerning the service boar. At time of breeding, marking with metal ears may be advisable for fairly accurate permanent records. Marks clipped in the hair serve as a quick identification when in the lot. These

marks may be on the shoulder or on the ham, on either right or left side, and may be varied to indicate such things as service boar if more than one is used, for the week of breeding.

Boars that are slow breeders. A good many boars are discarded because they are slow breeders or fail to settle the sows to which they are mated. Careful handling and proper management can overcome some of these difficulties. Dr. John Herrick of Iowa State College has suggested the following points which may be of considerable value in handling such boars:

1. A boar, if well cared for, is sexually mature at around seven or eight months of age.

2. Hand breeding is recommended in that the boar is spared unnecessary services and the gilts can be marked to determine farrowing time.

3. A young boar can serve 15-20 females at a breeding season. It is inadvisable to allow more than two gilts to be bred in one day. An older boar can safely serve three females a day and if properly managed can serve 20-25 females in a breeding season.

4. Many boars are timid or shy and will not breed when humans or other hogs are around. The female and boar should be placed together in an isolated pen. Some boars will breed only at night.

5. The breeding male should not be overconditioned and should have ample exercise, a well-balanced ration, and dry sleeping quarters. It is good practice to have the boar on the premises two to three weeks before the breeding season in order to have him acclimated to his new surroundings.

6. Crooked legs, poor feet, injured feet or legs, and other injuries will often prevent the boar from breeding.

7. Brucellosis often manifests itself in the reproductive organs of male and female swine. If breeding difficulties arise have the individuals in question blood tested.

8. There are many products on the market for shy-breeding boars. They in general are of no value, and only in a few cases will the use of hormones overcome cases of infertility in the boar and they should be selected and administered by a veterinarian.

Breeding records. One of the limiting factors in farrowing of spring pigs is the farrowing space available. It is an advantage to have all of the sows farrow within a short period of time, but the number to farrow should not be in excess of the capacity of the farrowing equipment. Breeding records are necessary to fit the intended farrowing to the farrowing facilities. A sow should be placed in the farrowing pen a few days before the calculated farrowing date. This is one of the greatest reasons for keeping a careful breeding record.

Breeding records give a check on the ability of the boar to settle the sows. They likewise give a check on the number of services necessary for each sow. It is not uncommon to have more sows bred than the operator intends to keep in the herd and sell the extras to farmers or on the market when enough of the sows have safely settled.

SUGGESTIONS FOR FURTHER STUDY

1. Make a study of some successful purebred herds and herds for market hog production to determine the methods of feeding, care and management.
2. Make up a breeding record for a swine herd.
3. Calculate the probable farrowing dates from a swine herd breeding record.

REFERENCES

- CARROLL, W. E. and J. L. KRIDER. *Raising Swine*. McGraw-Hill Book Co., New York
- SMITH, W. W. *Pork Production*. The Macmillan Co. New York
- United States Department of Agriculture:
Swine Production. Farmers' Bulletin, 1437F

CHAPTER 7

The Breeding Herd, Feeding and Management :

AFTER THE sows have been bred the next step is to properly feed and manage the herd until farrowing time, that is during the gestation period. The herd boar too needs good attention to be in condition for the following breeding season.

As most of the litters are spring farrowed the gestation period is during the winter season when pasture and field feeds are not available.

Winter problem. Mistakes in feeding and management are more common in winter than any other period. Forage is not available during the winter season; hence those qualities obtained from feeding on forage, such as sunshine, vitamins, exercise, comfortable surroundings, healthful sanitary condition, succulence, and mineral matter are more or less lacking in feeding on dry-lot in winter. The matter of housing, proper rations, watering, sanitation, disease, and parasite control are the most perplexing in caring for the swine herd in winter.

The farm operator to have a successful spring farrowing season must try to overcome the deficiencies which are common to the winter gestation period.

Summer problem. Maximum utilization of pasture is recommended for the breeding herd during the summer. Even when the confinement system is followed, the bred gilts and sows are commonly pastured during the summer. There is usually a carry-over effect from pasture feeding on subsequent dry-lot feeding. Although alfalfa meal is good supplement for a corn-soybean oil meal-minerals ration, it is not as good as pasture.



This picture shows the breeding herd on pasture. When pasture is available the breeding herd should make maximum use of it.



This breeding herd is on dry-lot. Good rations are needed for best results when the breeding herd is on dry-lot.

Feeding costs are lower, and results improved from using pasture for the breeding herd in summer.

FEEDING AND MANAGING THE BRED SOWS AND GILTS

Separation. There is not any great need for the separation of bred sows into small groups other than the segregation of the yearlings and older sows from the bred gilts. The labor involved in feeding the sows is greatly lessened by combining them into fairly large groups according to feed requirements.

Sows of different ages. The bred gilt at 200 to 250 pounds has acquired a third or half of her mature size. Growth of the gilt and growth of the fetus are going on simultaneously. The rations for the gilt should be rich in materials necessary for growth and fetal development. Protein of sufficient quantity and not lacking in quality, mineral matter ample in amount and kind, and vitamins are necessities for the bred gilt. On the other hand, the brood sow of greater age may have sufficient storage to forestall any current deficiency. The amount to feed and the composition of the ration differ for the younger sow from those for the older sow. The equipment suited to one size and age may not be so well adapted to the other. For these reasons gilts and older sows are usually separated.

Requirements during gestation. Adequacy of feeding becomes more important as pregnancy progresses. In the first two thirds of pregnancy the embryonic pigs make one third of their growth. The growth is increased in the last third of the period and deficiencies crop out. It is highly important good feeding be followed if good litters are to result. Gilts that are growing and also developing pigs can very easily be deprived of necessary nutrients.

Housing. Any housing that is good protection, free from drafts, dry, clean, sanitary, and comfortable is all right for the sow herd. The central house has definite advantages as the feeding can be done indoors and with greater ease. The watering, too, is less of a problem in colder sections if the central house is used. Although a labor saver in many respects, the use of the

central house requires more work in keeping it clean. The movable house prepared to afford ample protection is also very satisfactory for brood-sow housing.

Range. Winter range provides little forage in most sections. It is related with the matter of housing. When a large amount of

range is available, such as a cornfield, movable houses may be used. When feeding is confined to the farmstead lots, the central house may be used. There is no advantage in restricting the range, and many points may be given in favor of range. If a cornfield, or any field from which the crop has been removed, is to be had, it should make a good range and would also provide some feed.

Following cattle. Shotes make rapid gains while following well-fed fattening cattle. This plan is not a very good way of handling the sow herd, especially if the cattle are fed under rather crowded conditions. About 90 square feet are usually allowed per steer in the fattening lot. Yet the confining of sows to cattle-feeding lots is a very common practice. Injuries to the sows are likely to happen. Sows may contract some disease, such as tuberculosis; and the rations may not be adequate for the sow. If other suitable hogs are not at hand to follow the cattle, the sows may be used, but they should be removed six to eight weeks before farrowing. When a poor ration is allowed the sow, the ration can be improved by the manure pick up following the cattle.

Grain feeds alone. There is no one basal feed that makes a suitable ration for the sow in winter. Corn alone has been tried many times, but it always fails when used in this way. Other grains such as wheat, barley, oats, sorghum grains, and similar feeds are probably not superior to corn as a single feed, but we have heard less about them because they are used less in the entire ration. These grains supplement one another in an incomplete degree. Consequently, rations made up of grain mix-



This is a uniform lot of breeding gilts. It is generally advantageous to divide sows into lots uniform in size and age.

tures are but little better than the single grain. Supplements to be used with the different grains must be considered.

Corn. In spite of the fact that there is a great amount of evidence against the feeding of a ration consisting entirely of corn, it is a common practice, especially when corn is plentiful. The shortcomings of corn should be realized and its use confined to well-balanced mixtures. Healthy, strong litters of pigs of good size cannot be produced unless we provide proper supplements with corn. Corn, because of its lack in amount and quality of protein, and amount of mineral matters and vitamins, does not have a high efficiency in meeting the demands of the brood sow. Weak, small pigs and an increase in stillborn pigs result from a poor ration. Such troubles as difficulty in farrowing, pig-eating sows, failure to provide ample milk flow, and posterior paralysis after a period of suckling are common in sow herds fed rations such as corn alone. It has been noted from experimental results that corn can make up a relatively large part of the bred sow's ration and good results obtained. This is generally a timely question, for the hog feeder wants to know how much corn or other home-grown grains he can use and still be assured that the sows have enough of the essential nutrients.

Corn and cob meal or ground ear corn. This has been successful in rations for mature sows. As a part of the pregnancy and suckling ration corn and cob meal is satisfactory if fed with good supplements. In one test in which it showed up well, 80 parts of corn and cob meal was fed with 20 parts of protein supplement ($1\frac{1}{2}$ soybean meal- $1\frac{1}{2}$ tankage).

Barley. Where corn is not grown, as in the northern and western parts of the United States and parts of Canada, barley is the principal feed for swine.

Generally speaking, barley is a good hog feed, not so good as corn or wheat pound for pound, but quite efficient when properly balanced. When ground barley is 10 per cent cheaper than corn per pound it is economical to use.

Oats. As a part of the ration oats is an excellent feed for bred sows and gilts. Including some oats in the brood-sow ration is generally economical. Oats are of high protein content, which is in their favor as a hog feed. The fiber content is less objec-

tionable in the sow ration than in the ration for growing and for fattening pigs.

Other grain feeds. When other home-grown feeds are available and economical, nutrient value considered, they may be used for at least a part of the grain mixture. Certain feeds such as rye must be used with caution.

Combination of home-grown feeds. The farm grains are much the same in their nutrient qualities. All are lacking in several necessities of an adequate ration. Care should be exercised in selection of supplemental feeds, for if they do not bolster up the shortcomings of the home-grown grain, their addition may do more harm than good.

Protein-supplemental feeds. As noted previously, alfalfa hay and tankage serve well as corn supplements for sows. There are also many other feeds which serve efficiently for this purpose. These feeds are termed "protective" feeds as they insure against nutritional deficiencies.

The report of an experimental trial at the Iowa Station compares a group of these protective feeds. The record shows that:

1. Supplements generally proved advantageous, both for the gilts and yearling sows.
2. The supplementation usually increased the average size of the litter farrowed, the average daily gain, the weight of the litter, the average weight of pig, and the percentage of strong pigs.
3. Alfalfa hay proved superior to clover.
4. The sows fed hay in rack may not eat an ample amount.

Soybeans for sows. As the only protein supplement for sows soybeans makes a poor showing as compared to good mixed supplements. With a soybean and corn ration sows will not do very well during the pregnancy and suckling periods. If used for sows, soybeans should be limited to a small portion of an otherwise good ration. Generally it would be more profitable to sell the beans and use other feeds in rations for sows.

Soybean oil meal for sows. Because of the abundant supply of this feed there is much interest in its use in swine rations. As a single protein supplement with corn, oats, and minerals it will show good results in some situations. Mature sows pastured in

the fall make a good showing in the gestation and lactation period on such a ration. On the other hand if there is a long period of dry-lot treatment, gilts and sows may not do well in farrowing and suckling on such a ration. Furthermore gilts probably need more supplement than older sows during the pregestation period.

Other protein supplements. Skim milk, buttermilk in ordinary form, semisolid or dried, as well as fish meal, cottonseed meal, linseed meal, corn-oil-cake meal, corn gluten meal, and similar feeds may all be considered as possibilities when choosing a feed for the sow. Relative costs of the nutrients as well as physiological effects determine the choice. Of late years there has been greater use of mixed feeds for this purpose, and as the corn-and-tankage ration for fattening pigs has been improved upon. It is also outranked by other combinations for sows. The replacing of tankage with a balanced protein-rich mixture has not only been proven to be wise in practice but has also reduced feeding costs. Such supplements contain minerals, vitamins, and perhaps other essentials lacking in the basic feed.

Cottonseed meal for sows. It has been rather widely believed that cottonseed meal in quantities ample to balance rations would not be safe to feed pregnant sows. Recently reported work from the Texas Station indicates that this feed may be used quite successfully for brood sows. Encouraging results were secured from the inclusion of the cottonseed meal. The toxic materials contained in the meal (or its lack of vitamins) were counteracted by the other feeds.

Following are some of the observations from this work:

1. The sows that were properly fed cottonseed meal did not fail to conceive but bred regularly.
2. The cottonseed-meal-fed sows even in the second generation, gave birth to large litters of normal and well-developed pigs.
3. The cottonseed-meal-fed sows did not become constipated, blind, or overhot in summer.

These results in general show that brood sows, when they have access to pasture, breed regularly, and have practically just as

large litters when fed a grain ration containing not over 15 per cent of cottonseed meal (simple mineral mixture of limestone and salt added), as will sows on a tankage-supplemented ration. The sows also appeared to have a better appetite when fed the ration containing 9 per cent of cottonseed meal and 4 per cent of tankage than they did when fed the ration containing 15 per cent of cottonseed meal.

At the Iowa Station pregnant gilts were fed a mixture of tankage 30 pounds, linseed meal 30 pounds, cottonseed meal 30 pounds, and alfalfa meal 10 pounds, at the rate of 0.8 of a pound per head daily in addition to a basal ration of corn and a mineral mixture. This was fed through a winter pregnancy period and no trouble was experienced and the pigs were strong and of good size.

Legume hay supplements. At the Wisconsin Station, brood sows which were fed for months on corn, oats, or barley supplemented by such protein-rich feeds as linseed meal, wheat middlings, or field peas, with salt, gave quite consistently rather poor results. Even though the water supplied was rich in calcium, sows on such rations farrowed small litters of weak pigs, with a large percentage of dead pigs. Ground rock phosphate was apparently of no value for supplementing these rations; 15 to 25 per cent alfalfa furnished the proper supplementation and brought about normal litter production.

Alfalfa hay apparently is superior to clover hay for brood sows. It has been shown that soybean hay and cowpea hay are also satisfactory for brood-sow feeding. With coarse hay such as soybeans there may be considerable wastage.

Method of feeding alfalfa to sows. Feeding in the rack is a convenient method, yet the sows may not eat a sufficient amount of the alfalfa hay. Each sow should eat at least three-fourths of a pound daily. If consumption falls below this mark when rack fed, as it may when the quality of the hay is somewhat deficient, grind the alfalfa and mix with the other feed. When the consumption holds up, there is little advantage in grinding except to reduce wastage. This preparation may increase feed costs.

Is alfalfa sufficient for the entire supplement? For yearling or mature sows alfalfa hay with corn plus a mineral mixture and

water would be quite sufficient for most of the period of pregnancy. It may be advisable to add some protein-rich feed like tankage during the last few weeks. With gilts it would, under most circumstances, be the best plan to use some other supplementary feed in addition to the alfalfa.

Following are results of trials from the Wisconsin Station:

TABLE 6. ALFALFA HAY AS AN ONLY SUPPLEMENT VS. ALFALFA PLUS TANKAGE

FEEDS	POUNDS	DAILY GAIN, POUNDS	NUMBER OF PIGS FARE-ROWED	AVERAGE WEIGHT OF PIGS, POUNDS	PROPORTION OF VIGOROUS PIGS, PER CENT	FEED COST PER HEAD DAILY, CENTS
Lot I						
Alfalfa hay	0.5	0.93	7.12	2.25	80.8	5.6
Ear corn ¹	5.2	...	...	...	...	...
Lot II						
Tankage	0.30	1.00	7.90	2.34	89.2	5.5 ²
Alfalfa hay	0.48	...	...	...	...	...
Ear corn	4.7	...	...	...	...	...

¹ Ear corn reduced to the basis of No. 3 Shelled corn.

² Crediting excess gain over Lot I at 7 cents per pound.

The trials were conducted with gilts about 200 pounds in weight at the start, fed during the winter. The corn was limited to the amount deemed advisable to make satisfactory gains.

Alfalfa meal advantageous in the pregnant-sow ration. By using alfalfa meal in the sow ration the number of pigs raised can usually be increased. This will reduce the feed cost per pig.

A recent trial at the Iowa Agricultural Experiment Station gave the results given in the following table:

TABLE 7. COMPARISON OF SUPPLEMENT FOR PREGNANT SOWS

RATION SUPPLEMENT	NUMBER OF PIGS WEANED	PER CENT OF PIGS THAT LIVED
Plant protein	6.5	62
Plant protein plus 10 per cent alfalfa meal in ration	7.2	73
Plant and animal protein	6.5	69
Plant and animal protein plus 10 per cent alfalfa meal in ration	7.5	72

The ration addition of 10 per cent of alfalfa meal brought about an average increase of .85 or nearly one pig in the litter size weaned.

Silage for sows. Corn or grass silage, when properly fed with adequate supplementation, can be used for the major part of the sows' ration. Gilts will eat about 10 pounds of corn silage or 7 pounds of grass silage daily, while older sows will eat a few pounds more. When available, silage may be an economical feed as it is much like good pasture. Silage is not a complete ration. Its composition varies with the kind, the grain content, and the preservative used. For sows, silage should be fed with some grain, a supplemental mixture, ample vitamins, and minerals.

Methods of feeding. There has been a big increase in the self feeding of sows. The advantages are obvious, less labor is required, sows eat according to their needs, and more legume hay as meal will be consumed. Also when self fed, sows will not lose so much weight while being suckled, and the pigs will be heavier at weaning time. However, self feeders are needed, also mixing and grinding may be required. To follow this plan it is necessary to use some bulky feeds like alfalfa meal to mix with the more concentrated feeds like corn. If only concentrated feeds are used the sows will get too fat. It is not uncommon to self feed a part of the ration and hand-feed the remainder.

Rations for pregnant sows.

1. Self-feeding the entire ration. The rations in Table 8 have given satisfactory results under farm conditions. Attention is called to the fact that the size and age of the sow, as well as the inclusion of pasture, are factors in selecting a feed combination. Also the need for a better ration becomes greater as the sows approach farrowing.

Good quality feeds are to be used in the above mixtures. Alfalfa can be increased in the mixture if it is economical particularly for older sows. Up to 50 per cent has been used with success. For older sows the protein supplement can be reduced in amount especially on pasture and during the first part of pregnancy. Gilts if rather small may need more protein supplement. Minerals may be self-fed.

TABLE 8. RATIONS FOR SELF-FEEDING SOWS

AGE FEEDS	Without Pasture		With Pasture	
	SOWS, POUNDS	GILTS, POUNDS	SOWS, POUNDS	GILTS, POUNDS
Ground shelled corn.....	633	615	620	620
Ground oats.....	614	600	1260	1210
Ground alfalfa.....	633	615	....	....
Protein supplement.....	100	150 to 200	100	150
Mineral supplement.....	20	20	20	20
TOTAL.....	2000	2000	2000	2000

2. *Hand-feeding a part of the ration.* Hand-feeding of corn is practiced by some along with self-feeding of the other feeds. The corn is fed on the ground, or feeding floor usually some distance from the quarters. It may be shoveled from a wagon or crib in the amounts needed daily. A saving is made by this method as grinding for mixing is eliminated. The amount is regulated in accordance with the weight gains of the sows. A mixture such as ground oats 47 per cent, ground alfalfa 47 per cent, and good protein supplement 6 per cent is suitable for self-feeding with the hand-feeding of corn. Gilts probably would need about twice as much (12 per cent) protein rich feed or good protein supplement.

It is good practice to self-feed legume hay such as alfalfa or soybean hay or meal, a mineral mixture and salt in addition to the remainder of ration.

3. *Hand-feeding the entire ration.* Care must be used in hand-feeding, as the amount fed should be enough so that there is a gain on the sows of about one pound per head daily or more. A good bred sow ration can be made as follows:

a. Corn: Ear or shelled amount to be fed is dependent upon the condition of the sow. Usually from one to two pounds per 100 pounds live weight.

b. Oats whole: One to two pounds per head daily.

c. Protein supplement: One-fourth to three-fourths pound per head daily.

d. Mineral mixture: Self-fed.

The foregoing are merely suggested rations to be used as general guides, and substitute feeds may be wisely included when economical. For example, in place of corn we may use barley or wheat. Other good legume hay may be used in place of alfalfa. Many other satisfactory combinations are widely used and there is not any best ration for winter sows.

In general such ration for gilts on dry-lot should contain about:

- 10 per cent protein supplement
- 10 per cent to 15 per cent *or more* alfalfa meal or hay
- 74 per cent to 79 per cent cereal grains
- 1 per cent mineral mixture

When alfalfa hay is relatively cheap the quantity is to be increased especially for sows.

Adjusting the ration. The amount of the ration to feed is dependent upon the condition of the sows and the weight increase. If the sows lack in degree of fatness or they are not gaining about one pound per head daily, the feed allowance should be increased. A convenient plan is to feed the basal feed separately and in varying amounts, and to feed a constant amount of the supplement. In self-feeding, if the sows are getting too fat, increase the hay portion of the feed mixture; and if the reverse is true, increase the amount of grain.

Amounts of concentrates to feed pregnant sows. The minimum allowance of concentrate feed needed for sows is at least 1.25 pounds of concentrated feed for each 100 pounds live weight. Since sows should gain in weight during the pregnancy period the minimum is inadequate. Growing gilts need more feed per unit of weight to make possible normal growth. In addition to growth there should be a gain of at least $\frac{3}{4}$ of a pound per sow daily during pregnancy. When access is given to alfalfa meal or hay the allowance can be reduced accordingly. The daily concentrated feed allowance for sows of different classes is shown in Table 9.

Many farmers judge the amount of concentrate feed to be fed by the condition of fatness of the sows. The principal feed, usually corn, is varied in amount fed to maintain good flesh in the

TABLE 9. CONCENTRATE FEED ALLOWANCE FOR SOWS OF DIFFERENT CLASSES

CLASS	TOTAL CONCENTRATE FEED DAILY PER 100 POUNDS LIVE WEIGHT
Growing gilts	3.00-4.00
Pregnant gilts	1.80-1.90
Pregnant sows	1.25-1.40
Sows suckling litters	4.00-5.00

sows and to prevent overfatness. Feeding feeds like corn to the extent that the gilts or sows are noticeably fat at farrowing is not a good practice. Such sows are not good pig producers or sucklers.

Feeding dry. An increasing number of farmers feed their brood sows dry feeds. This system involves far less labor and under most circumstances is equally as efficient as wet feeding.

Wet feeding or slopping. Wet feeding is widely practiced by many of the older swine raisers. It may prevent wastage of the feed with such feeds as ground grains, wheat middlings, or similar feeds. It may also increase water consumption in winter weather. If a small amount of milk is available this may be more evenly distributed among the sow herd, which is advantageous. The two main objections are the inconvenience both in mixing and feeding and the extra labor involved.

Soaking is an adaptation of the wet or slopping method of feeding involving the soaking of the dry feed from one feed to another. With hard grain this practice may be of some avail, but it is inferior to grinding hard grains and it seldom returns as much as anticipated. The Iowa experiment on various forms of barley showed that whole barley was not improved by 24 hours was apparently decreased in value

Winter pastures. When available, pasture should be used for the sows in winter. This overcomes many of the possible "lacks" in the ration and in addition induces exercising. However, most pastures, except in warm climates, are very scant sources of feed

in winter and should be looked upon as space for exercise rather than as a supply of feed.

Mineral supplements. Winter rations are far more apt to be lacking in mineral matter than are summer rations because of the absence of pasture and the limitation of range. If the ration lacks in inorganic nutrients, a mineral mixture supplying these would give excellent results. Mixtures are often provided for the purpose of insuring against a definite lack of the inorganic substances. Outstanding deficient mineral elements are calcium, phosphorus, sodium, chlorine, iodine, iron, copper, and perhaps others.

Minerals for growing gilts. There is more need for an ample mineral mixture for young gilts than for older sows because of growth and pregnancy demands. At the Iowa Station it was found that gilts fed mineral mixtures outgained with less feed the group in which salt provided the only mineral other than that in the feed and water. When tankage was used as the supplementation in the nonmineral vs. minerals comparisons, larger and stronger pigs were produced when minerals were fed. The sizes of litters were not influenced by the mineral mixture.

Kinds of mineral mixtures. A great variety of mixtures is available. Many commercial mixtures are on the market, and there have been numerous home-made mixtures advocated. In selecting one it should be remembered that economy, quality of ingredients, and the kind and proportion of component parts are the important considerations. With commercial mixtures the reliability of the manufacturer is also important.

TABLE 10. A SATISFACTORY MINERAL MIXTURE

	PER CENT
Ground limestone, high calcium, finely ground	40.00
Bone meal	37.60
Salt, common	20.00
Iron, ferrous sulfate	2.00
Copper sulfate	.05
Potassium iodide, (stabilized)	.05
Manganese sulfate	.30

Mineral mixtures have passed through a period of radical modification and as yet our knowledge of the necessary components is incomplete. We are sure of the need under many conditions for the elements included in the foregoing mixture to supplement average swine rations. Perhaps in some instances the other trace elements such as cobalt, zinc, and potassium will prove too advantageous, especially on dry-lot. To supply these trace minerals we could add .1 per cent cobalt chloride or carbonate, .05 per cent zinc carbonate, and .2 per cent of potassium carbonate to the above mixture. There are convenient commercial trace mineral premixes on the market. When on pasture a mixture of ground limestone two parts, steamed bone meal two parts, and common salt one part will probably be sufficient.

At one experiment station, gilts on low-calcium rations (about 0.6 grams of calcium daily) farrowed large litters, but several of the pigs were weak and none were very strong. Also, inability to secrete milk markedly limited the suckling ability of the sow. The lot of the sows on the calcium-low rations had very weak bones and two of the five gilts suffered broken legs. The occurrence of hairlessness in newborn pigs is prevalent in regions where there is an iodine deficiency. The inclusion of iodine in the form of potassium iodide or sodium iodide stabilized in the pregnant sows' ration will prevent hairless pigs.

TABLE 11. LEVELS OF CALCIUM AND PHOSPHORUS, IN THE DRY RATION SUGGESTED FOR GILTS AND SOWS.

	<i>Per Cent of Dry ration</i>	
	CALCIUM	PHOSPHORUS
Pregnant gilt 250 pounds		
Early pregnancy	.25	.2
Late pregnancy	.4	.3
Lactating sow 400 pounds.	.45	.35

How to feed the mineral mixture. Self-feeding free-choice style is the common method of feeding. Consumption will be about one pound per head per month. It may be mixed with the feed and if included in the supplemental mixture usually between 2 and 5 per cent of mineral mixture is included in a rather

complete mixed supplement or 1 or 2 per cent included in the entire mixed ration. Even though it is included in the feed it is also advisable to self-feed, as well.

Vitamin feeds for sows. Some rations for sows may be lacking in vitamins D, A, B complex, and E. The first-named is the one which is most likely to be lacking. However, the inclusion of alfalfa meal, ultraviolet ray irradiation, irradiated feeds, or cod-liver oil will overcome its lack. For vitamin A, yellow corn will provide an ample amount. It is also carried in alfalfa. Vitamin E is present in whole grains; consequently, it is in most swine rations. Before buying feeds for sows on the basis of vitamin potency, feeders should carefully ascertain the need. Rations satisfactory in most respects for swine generally contain ample amounts of the vitamins.

Stock tonics for sows. If the sows are doing well, that is, gaining properly and appear healthy, there is no need to use a stock tonic as a stimulant. If the sows are not doing well, carefully check over the ration, and if it is adequate, secure professional advice as to the cause of the trouble. Experimental trials of state and federal experiment stations have in most cases shown uneconomical results from the addition of the so-called stock tonics.

Feed preparation for brood sows. It is generally regarded as advisable to prepare all of the small, hard grains such as wheat, barley, sorghum grain, and kindred feed for brood sows. Oats, if making up very much of the ration, should also be ground, but if a small amount is used it may be fed whole advantageously. The preparation of the corn has little if any effect upon the character of the newborn pigs and does not materially affect the gains on the sows. Hence, the objection to grinding the corn lies in the cost. There are several methods of feed preparation that are used in swine feeding. These, with the exception of those previously noted, are of little value in brood-sow feeding, when they are fed limited rations.

Total feed for brood sows. It is convenient to have some measure of feed needed by a sow for a production period. A feed budget should be worked out by the farm operator. The following is suggested as a guide in the preparation of such estimates.

TABLE 12. FEED NEEDED BY A SOW FOR A PRODUCTION PERIOD

	CORN, BUSHEL	OATS, BUSHEL	PROTEIN SUPPLEMENT, POUNDS
Period 1	10	3	45
Period 2	12	2	60
Period 3	4		5
TOTAL	26	5	110

For the substitutes to use instead of corn and oats refer to Chapter 11 which gives the relative value of grains and basal feeds. The protein supplements are discussed in Chapter 12.

Exercise. Much has been written in favor of exercise of the brood sows; however, pregnant sows with restricted range or exercise farrowed normal pigs if the nutritive ratio was adequate. Perhaps there are some secondary beneficial effects from exercise, such as sunlight exposure, more healthful condition etc. It may be, under actual farm conditions, that the great range included with the exercise makes possible the inclusion dietary factors which would be deficient on restricted range. Regardless of the reasons, it is generally accepted that exercise for brood sows is decidedly an advantage, under average farm conditions. Feeding at a distance from the sleeping quarters is a common plan of encouraging exercise. The distribution of ear corn by a manure spreader is also quite common.

Parasites. Daily observation of the sow herd should be practiced. The attendant should be continually in search of parasites, of which the hog louse and the mange mite are the most common. Early identification of any parasitic condition permits easy eradication. Winter treatment for parasites with crude oil, lime-sulfur, DDT, benzene hexachloride or similar materials should be practiced with caution.

Diseases. The attendant should likewise be on the lookout for diseases among the sow herd. Immediate isolation should be practiced until a definite diagnosis is made. Breeders should watch carefully for symptoms of abortion disease. Hog flu is also quite common in sow herds in winter.

FEEDING AND MANAGING THE HERD BOAR

The care and handling of the boar during seasons when not in active use determines to a large degree the vigor, activity, and condition of the boar during the period of breeding. The results at farrowing time may, therefore, be influenced by the treatment of the herd sire.

Separation of the boars. At the close of the season for breeding, the boar should be removed from the sow herd. If more than one boar is kept in the swine herd, it is usually advisable to keep them together during periods between breeding seasons. The boars will fight when first put together, but before long one will establish superiority and there will be little fighting. Boars that are greatly different in size should not be turned in together. In addition to the damage to the smaller boar from fighting there is the difference in feeds needed. It may be necessary to separate the boars after they have been together for a time if one of them is being injured. The behavior of the boars is carefully observed until they have become accustomed to each other. If boars are put together in a lot of good size after their tusches have been removed, there is little chance of damage resulting. Boars when kept together will take more exercise and can be maintained at lower cost.

Housing the boar. It is seldom feasible to house the boar in the central log house. A movable house will provide ample shelter and protection even when climatic conditions are quite adverse. For large boars a large portable house is needed, and the door should be high enough for the boar to pass through without rubbing his back. The door may be closed with a double sack in the severe weather. A-type houses are usually too small for a large boar, and heavy boars very often push off the side boards. A box-type house, well constructed, with proper ventilation in the roof ends, will provide ample housing facilities.

Range allowance and fencing. A large lot is not necessary for the boar, but a serious mistake is made when a boar is confined to a very small filthy lot. A lot 30 feet wide and 100 feet long would give ample range for a boar. A lot that is quite high, dry, and well drained is preferred. If the fence is to be of woven wire

it should be at least 39 inches high. If 32-inch woven wire fence is used for other swine lots the supplement of two strands of barbed wire will suffice.

Feeds to use. The feeds selected for use must fill the requirements and must be economical. As limited feeding prevails, bulky feeds are advantageous in the boar ration. The feeds then should include such bulky feed as oats, alfalfa meal or hay, and similar materials. The ration used for sows would be all right for the boar and perhaps the most convenient to feed. Breeders should guard against heavy feeding of corn or other highly concentrated grains. These home-grown grains are unexcelled for a portion of the ration but because of their inadequacies are to be used only in balanced mixtures.

Rations for boars. A commonly suggested mixture of feeds for herd boars is given: corn 40 per cent, oats 40 per cent, wheat bran 10 per cent, and a high protein supplemental mixture 10 per cent. This may be modified to suit local conditions, considering the availability and economy of various feeds. Any of the corn substitutes—barley, wheat, grain sorghum, and similar feeds—may take the place of the corn. Oats may be replaced by the use of the grains of somewhat similar composition, as wheat or barley. The wheat bran may be replaced by similar feeds having approximately the same physiological effect or it may be omitted. In the latter case the supplemental mixture should be increased to 15 per cent. If milk by-products, skim milk, or buttermilk, are available they may be used in lieu of the supplemental mixture. In the absence of good pasture, alfalfa meal is necessary.

Boars of different ages and conditions require different combinations. The following has been regarded as a good ration for a growing boar: corn 60 per cent, oats or wheat middlings 25 per cent, supplemental mixture 15 per cent plus a mineral mixture self-fed.

Feeding the boar. Self-feeding is not practiced with breeding boars. Hand-feeding twice daily is the most common plan. Many boars are given feeds in slop form, but there is no advantage from a nutritional standpoint in mixing the feed with water. However, it may prevent wastage from the trough.

Amount to feed. Boars should not be allowed to become fat. Limit the feeds to the needs of the boar. If the boar is young, make the allowance great enough to permit normal growth—probably about three pounds of feed daily per 100 pounds live weight. Mature boars usually need about one-half of this amount, or about $1\frac{1}{2}$ pounds of feed to 100 pounds of live weight. A 700-pound boar would need, according to this schedule, about 10 or 11 pounds of feed daily to keep him in good condition. A young boar, at 400 pounds, would need as much or slightly more to meet his needs.

Watering. Water is needed daily as a part of the ration. If an automatic fountain is in the boar lot, his needs would be well met with but little inconvenience to the operator. Fountains are not often available in boar lots and watering by hand is the more common custom. Water should be allowed twice daily, and in freezing weather the water trough should be dumped when the boar has taken his drink. One advantage of putting water with the feed is that the boar is more likely to get the amount of water he should have.

Parasites. In winter, a manager must be continually on the lookout for parasites. Mange, mites, lice, and kindred parasites spread rapidly when animals are in confinement. Careful watching will detect the first presence, and will make eradication less difficult.

Exercise of the boar. A lot for range is needed, in which the boar will take exercise. This is encouraged by keeping two boars together, or in the absence of a second boar a barrow or a bred sow may be put with the boar. By changing the place of feeding and having it some distance from the house, the yard may be kept cleaner and the boar will take more exercise to get his feed. Older boars may refuse to take sufficient exercise voluntarily, in which case the keeper should resort to driving the boar daily, or provide some other means of exercise.

SUGGESTIONS FOR FURTHER STUDY

1. Make a survey of practices used in swine breeding herds in your section. Determine the extent of self-feeding sows.
2. Prepare a list of problems confronting swine raised with their breeding herds.

3. Calculate the amount of feed needed daily for a 200-pound growing gilt, a 250-pound pregnant gilt, a 450-pound pregnant sow, and a 500-pound suckling sow.

REFERENCES

- MORRISON, F. B. *Feeds and Feeding*. The Morrison Publishing Co., Ithica, New York
- SMITH, W. W. *Pork Production*. The Macmillan Company, New York

CHAPTER 8

The Farrowing and Suckling Period

THE FARROWING PERIOD

SUCCESSFUL FEEDING and management during the fall and winter is of no avail if the herd is neglected during farrowing. Handled properly up to this time, the sow is ready to produce good, strong, healthy, large litters. Such pigs may become chilled, injured, or worm infested and their number depleted and their development arrested. Proper handling will permit the raising of a large proportion of the live pigs.

Need for attention at farrowing time. The maximum amount of labor in swine husbandry is required during the season of farrowing, especially in the spring. If the farrowing is early in the spring, more attention to the breeding herd is needed for success. Yet there is an advantage in early farrowing from the labor viewpoint, because there are but a few other farm enterprises requiring much attention at that time. Later farrowing of the spring pigs demands less attention of the operator as farrowing under mild weather conditions reduces pig losses from chilling. In fact, late spring pigs are often farrowed out on the pastures with but little attention.

Amount of labor involved. In many pig-production contests it has been found the man who spends his time around the farrowing house during farrowing season raises the largest number of pigs per sow. The number of pigs raised is determined very largely by attention given the herd during this critical period and by good equipment.

In 13 years of recognizing the 25 ranking Iowa Master Swine Producers, the average litter size was 10.01 pigs farrowed, 8.92 pigs weaned, and 8.78 pigs raised. The loss to weaning time was less than 12 per cent.

The U. S. D. A. pig crop survey indicates that for a ten-year average 6.90 pigs were saved per sow farrowing for the spring litters and 6.78 pigs for the fall litters. We have increased in numbers of pigs raised per sow but there is room for much improvement.

The poorer the equipment the more personal attention is required. As long hours are often required in the season of spring farrowing, and sometimes day-and-night attention is needed, there is a great advantage in having the sow herd farrow within a short period of time. A man can take care of 20 to 25 sows at this time if he has fairly good equipment; this is an ample number of sows for a one-family farm of average size.

Surveys indicate that in general larger hog enterprises are the most profitable. Farmers raising four litters or less per year usually receive the lowest return over feed costs.

Litter size. Even though there is greater mortality in large litters the size of the litter raised is in favor of the large-sized litters. Perhaps we can have too prolific sows but the reverse is commonly the case. We need therefore to understand the conditions which are related to litter size. There is a relation already shown between the breed of swine and the number of pigs farrowed. We have also seen from experiments reported that the size of litter is influenced by the feed just before breeding time, "flushing," and the feeding during pregnancy. Other factors which may have some effect upon the litter size are: age of sow; service boar; type of individuality of sow; time of mating; and perhaps other factors.

Age of sow. It has been found that sows appear to reach the maximum degree of prolificacy at about four years of age, or the sixth or seventh litter. As age advances the percentage of pigs born dead increases. Aged sows crush more pigs than younger sows. Environmental factors and variations are more important in farrowing losses than the age of the sow. Older sows have heavier pigs and also wean their pigs at heavier weights.

Age of first mating. This may influence the size of litters but its effect has not been proven experimentally. It has been found that prolonged suckling has a more definite influence on the future development of the sow than pregnancy. Early breeding, no doubt, lessens the productive life of a sow. Under actual practice, breeding too early, or when the sows are too young, is not a common fault. No doubt, the feeding is the most troublesome factor in early breeding, for, under good feeding conditions, no serious damage can result from breeding well-developed sows at eight months of age. One common mistake is the late breeding of sows. Sows kept open for showing or other purposes are difficult to get with pig and are highly uneconomical.

The service boar. A fully fertile service boar, if not overworked and in good condition, has no influence in the number of pigs in a litter. The assumption is based upon the fact that upon copulation millions of spermatazoa are deposited in the vagina. Some sows are more prolific when mated with one boar than with another, which may indicate an influence of the sire on prolificacy. If the boar is partially infertile the litter size will be affected.

The type and individuality. The bacon breeds are more prolific than the lard breeds, and the large types excel the small types. The breeds that are small in size, like the Essex, Cheshire, and Small Yorkshire, are less prolific than the larger breeds. The principal progenitor of the domesticated hog, the European wild boar, lacks in prolificacy in comparison with the present-day swine. Within breeds, prolific strains have also been identified.

Time of mating. As generally believed, service rather late in the period of heat or oestrus will yield larger litters. The sow is believed to shed her eggs about 35 hours after she first comes in heat. If ten hours are allowed for the sperm to travel up to the uterus it would seem that service 25 hours after the beginning of heat would give the best results. Forced service just after heat is over rarely, if ever, produces a litter.

Number of fertilized eggs which develop to birth. Not all of the eggs which start to develop continue to grow up to the time of birth. Some die in the womb and are absorbed, or are born in a mummified condition. In one study 21 sows in pig were

slaughtered and examined. The average number of eggs shed was 18; the number of normal young was 12; the number of degenerate young was 2; the remaining 4 were not found, either because of nonfertilization or early degeneration. The reasons for this degeneration have not been determined. They may be nutritional, hereditary, or due to crowding of the fetuses in the uterus, resulting in insufficient nutrition.

Time of farrowing. Most of the pigs are farrowed in the spring of the year. A recent study of the time of farrowing indicates a distribution as given in Table 9.

TABLE 13. PER CENT OF SOWS FARROWING BY SEASON AND MONTHS—FIVE YEAR AVERAGE

SEASON	MONTH	PER CENT
	December	2.4
	January	2.9
	February	5.9
	March	16.3
	April	22.1
	May	12.5
Spring total.....		62.1
	June	5.2
	July	4.3
	August	7.1
	September	11.7
	October	6.7
	November	2.9
Fall total.....		37.9

In government reports pigs farrowed from December to May inclusive are spring pigs, while the remainder are fall pigs.

The heavy farrowing in the spring accounts for the heavy market receipts of hogs from November to February inclusive.

Favorableness of the feeding ratio, hog-corn price ratio, and weather the previous year cause farmers to change the breeding plans. When the feeding ratio is favorable, increased breeding of swine occurs. It has been found that the supply of corn on hand October 1 of each year is closely related to the number of sows to farrow the following spring. A 10 per cent increase in

the corn supply October 1 in Indiana was followed by a 5 per cent increase in the number of sows farrowing the next spring. If the spring season is late and unfavorable for pigs, spring farrowings are usually delayed the next year.

Multiple farrowing. Since hog "gluts" commonly occur during the four months November to February inclusive many have suggested means of spreading out the receipts. One method is to increase the number of fall-farrowed pigs. This would accomplish a better distribution of hog slaughtering. The objections to the heavy marketing in the winter months is that 40 per cent of the yearly supply is marketed in four months. This taxes the marketing channels as well as the packing plants.

Lew P. Reeve,¹ Hormel and Company, has advocated a multiple-farrowing system. This system is based on each hog-raising farmer keeping three sets of sows which would farrow two litters of pigs a year. The sows would be bred to farrow every two months throughout the year and hogs would be marketed every two months during the year. The need for a better marketing distribution is illustrated by the facts in the following table.

TABLE 14. HOGS MARKETED MONTHLY AND CHICAGO
MARKET PRICE

MONTH	RECEIPTS, THOUSANDS	PER CENT MKT'D PER MONTH	CHICAGO PRICE, AVERAGE
January.....	4839	11.4%	\$ 9.32
February.....	3923	9.3%	9.68
March.....	3605	8.5%	10.25
April.....	3250	7.7%	10.23
May.....	3462	8.2%	10.15
June.....	3347	7.9%	10.05
July.....	2911	6.9%	10.31
August.....	2610	6.1%	10.37
September.....	2611	6.2%	10.51
October.....	3329	7.9%	9.81
November.....	1932	9.3%	9.22
December.....	4465	10.6%	8.92

(The table covers all hogs marketed at public markets from the years 1915 to 1934, giving the totals for each month in those 20 years and the average price paid for hogs at Chicago for each month.)

¹ *The Hormel Farmer.*

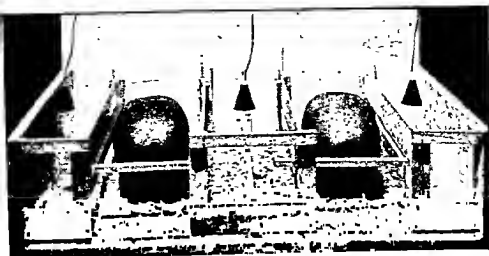
In all probability there would be less yearly spread in hog price if there was a more even distribution of receipts.

The farrowing house. In Chapter 18, "Swine Housing and Equipment," the merits of the central and movable houses were enumerated. A man can take care of more sows in a central house. However, the housing cost is larger. If movable houses are to be used, one should attempt to simulate central-house conditions. The movable houses should be so well constructed as to be dry, free from drafts, and fairly warm. They can be moved close together for convenience of the attendant, and each may be provided with a small fenced lot for exercise. One common method is to line the movable houses up along a concrete slab that serves as a lot. In this way the mud prevalent in the early spring is avoided. If needed, one movable house may serve as a pig hover for several movable houses adjoining it or an electric pig brooder may be used.

The farrowing pen should be large enough to accommodate the sow conveniently. A pen 6×6 feet is the minimum size when the sow is fed outside the pen. A large pen has advantages. Of course, the manager wants to get as many pens in the house as possible as this is economical utilization of the building, and it makes heating less difficult. Pens 7×7 feet should be regarded as the smallest size to be used if yearlings and mature sows are kept in the herd. A pen 8×9 or 8×10 feet is needed if the sows are fed in the pens.

The farrowing stall. The farrowing stall is used to confine a sow when she is expected to farrow and for two to fourteen days of the suckling period. The sow is removed for feeding and for cleaning of the stall. By the use of farrowing stalls, fewer pigs are crushed and it is possible to reduce losses from chilling as the pigs are confined to a small area. Electric light bulbs are used when heat is needed.

Removable built-in farrowing stalls can be adapted to a central farrowing house or to movable hog houses. The crate is made about 24 inches wide and 6 to 8 feet long. The bottom plank of the sow-confining part is about 10 to 12 inches from the floor, thus providing a protected place for the pigs which can be warmed. Plans for farrowing stalls are available at several Midwest agricultural experiment stations.



This is a model of farrowing stalls with heat lamps.

Guard rails or pig fenders. The loss of pigs from crushing may be very large. This can be reduced by the use of pig brooders, or guard rails. It is usually the small, less active pigs that are crushed. Consequently proper feeding and disease control are not to be overlooked in reducing crushing losses. There is less need for rails when a pig brooder is in the pen. Yet they may save some pigs, especially with older sows. Many means are used to provide this safety for the pigs. A pipe or rail 8 to 10 inches from the floor and 8 to 12 inches from the side of the farrowing pen will suffice. A 2 × 4 is satisfactory and can be easily installed. It is hardly possible to eliminate all crushing losses but good equipment is a big help. Separation of the sows from the pigs for feeding is also helpful. A pig creep too may be a pig saver.

Sloping the farrowing pen floor. When the floor of the farrowing pen slopes, the sows lie down with their backs toward the high side of the pen. The pigs will go to the low side. This may be a way of reducing crushing losses, especially in movable houses.

Bedding the farrowing pen. Well-selected bedding is essential for good results in caring for pigs in the farrowing house. Concrete floors may be cold and quite a bit of bedding needed.



A jug of hot water is put in an old wash tub, making an improvised pig brooder. Note that the pigs have been ear-marked.

The bedding is to be kept clean, dry, and evenly distributed. When pens are heavily bedded a depression is often made causing the pigs to lie close to the sow increasing the danger of crushing especially in cold weather. Ground corn cobs shavings or fine cut straw are excellent to use and will cover the floor with uniform thickness. Some use of hydrated lime has been made with the bedding in farrowing pens. Poultrymen have

used this material successfully in brooder and laying houses.

Temperature in the farrowing house. It is well to have some means of heating the farrowing house if the temperature within it may drop to 50° F. during the farrowing season. A range from 50° to 60° F. is desirable in the house at farrowing time. A hog house equipped with some means of heating is highly advantageous if early pigs are to be raised. A lantern can be used to remove the chill in a movable house. Pig brooders supply heat economically where it is most needed, for the young pigs. It has been found that pigs kept without feed would survive three times longer when the temperature was 85° to 90° than they would when the temperature was 55° to 60°. The heat-control mechanism of the pig is not fully developed at birth. The temperature of the pigs drops after birth. It is not until they are 50 to 60 hours old that they develop their heat-control ability.

Electric pig brooders. The use of an electric light bulb has proven to be the best for providing heat uniformly in a pig brooder. They can be used in a central or movable house. Such equipment will reduce death losses of young pigs from chilling and crushing. Heat can be applied where it does the most good.

Electric pig brooders in one test resulted in saving 82.8 per cent of the live pigs farrowed. Under somewhat comparable con-

ditions without electric pig brooders 65.7 per cent of the pigs were saved until weaning time.

In some cases satisfactory results are obtained by merely using a heat lamp over the sow and litter in the center of the farrowing pen. The common method is to build a pig brooder in the corner of the farrowing pen which gives a protected area.

Heat hulbs can be used but they should be at least 24 inches from the floor. Ordinary bulbs ought to be 14 inches from the floor. Some manufactured brooders use heating elements to provide the necessary warmth. A 100 to 150 watt lamp will give sufficient heat in a manufactured or home-made brooder. Under average conditions the heating part will have to be operated only until the pigs are ten days old. From 24 to 36 kilowatts are required for the ten-day period. Constructing home-made electric pig brooders is covered in Chapter 18, "Swine Housing and Equipment."

Precautions in using pig brooders. Fires have been caused from pig brooders in hog houses, and the following precautions are suggested to reduce this hazard.

1. The wiring should be adequate to carry the additional electrical load.
2. The brooders are to be fastened securely so that the sow will not break it. Further, they need to be substantially made.
3. Electric wire on the light should not be within the reach of the sow.
4. Lights are to be protected from water which may have condensed upon the ceiling and may fall on them.
5. Straw and litter is to be kept away from the lamp bulb and a screen used to shield the light at the brooder opening.

Causes of pig deaths. Crushing is the cause of the greatest number of deaths in young pigs. This may amount to from 10 to 15 per cent of the pigs farrowed, or about one-fourth to one-half of the pigs that die during the suckling period. Pig brooders, guard rails, and good management will prevent this loss of pigs. It should be pointed out too that many losses from crushing are due to the fact that the pigs are small and runty. Subnormal pigs

are not alert and active. One survey of pig losses other than crushing in the 11 main hog-raising counties of Illinois on farms where the disease losses were high indicated the following distribution of death causes.

1. Chilling with hypoglycemia (low sugar in the blood)—41 per cent.
2. Nutrition problems—25 per cent.
3. Diarrhea and vomiting—17 per cent.
4. Brucellosis—8 per cent.
5. Hereditary factors—6 per cent.
6. Poor equipment—3 per cent.

It should be pointed out that losses listed above are mainly those from diseases. These vary considerably from herd to herd also from year to year. When the spring is cold and wet, death losses are higher. Nevertheless, management, sanitation, and nutrition can have much to do with death losses of young pigs.

How can we reduce to a minimum the death losses listed above? Chilling losses can be lessened by the proper use of heating equipment and pig brooders. The other losses can be controlled in part by good feeding and management and equipment, as well as proper disease-control measures, not only during the farrowing period but also prior to that time. So important are the losses from feeding and disease during farrowing that they are discussed somewhat in detail in the following paragraphs.

Birthweights of pigs. Since heavy pigs at birth have a better chance of surviving, some consideration should be given to the importance of such weights.

1. Relation of birthweight of pigs and vigor. As generally believed, the largest pigs are the strongest, and the pigs of light weight are the weakest. One ideal as regards a litter at birth is to have a good number of large, vigorous pigs. Strong, good-sized pigs usually make the most rapid and economical gains. There is a definite relation between size and vigor of newborn pigs.

It was found that the pig's chance of surviving the suckling

period increased up to the weight of 2.8 pounds. Increases in birthweight above this were not related with the percentage raised.

2. *Factors that influence the birthweight of the pigs.* In addition to the matter of feeding, both before and after breeding, many other conditions may influence the size of a newborn pig. The more common of these conditions which have been studied are listed: the number of pigs in the litter; the age of the sow; breed; crossbreeding; inbreeding; and sex. No doubt other factors affect the birthweight of pigs.

Pigs in larger litters are usually small at birth. Older sows have heavier pigs than gilts. Crossbreeding will probably increase birthweights, while the reverse is true with inbreeding. Boar pigs outweigh sow pigs.

3. *Birthweight and weights at later periods.* Heavy pigs at birth are very likely to retain their weight advantage. Because of this advantage the farmer growing market hogs wants heavy pigs at birth inasmuch as they are heavier at marketing time. However, the final weight of the entire litter, rather than the final weight of the average pig is to be considered. Unless there are at least eight pigs in a litter it is almost impossible to make the litter weigh a ton or more when they are six months old. Big litters of heavy pigs are the real objective of the hog grower.

A U. S. Department of Agriculture study on 1,429 pigs revealed that for each pound variation in birthweight, there was a corresponding variation of approximately 0.1 pound in the average daily gain up to 190 days of age. Pigs weighing 1.5 pounds at birth made a daily gain of 1.18 pounds while 2.5 pound pigs at birth made an average daily gain of 1.32 pounds. The heaviest group which were 4.0 pounds at birth had a daily gain of 1.44 pounds.

Pigs at the Nevada Station were divided for a feeding trial into three groups on the basis of birthweights. The cost of gain on the heavy pigs was 89 per cent and the medium pigs 91 per cent as much as that of the lightweight pigs.

When do death losses occur? Beeson has reported upon time of death losses in the Purdue Swine Farm herd over a period of 24 years. The average litter was 9.8 pigs when farrowed and 6.42

pigs at weaning time. The loss was 34.56 per cent which included 5.16 per cent of stillborn pigs.

TABLE 15. DEATH LOSSES CLASSIFIED BY PERIODS

PERIOD	PER CENT DEATH LOSS
1 stillborn	5.16
1 to 3 days	18.22
4 to 14 days	6.48
15 days to weaning	4.7
	34.56

The heavy losses are during the first three days. In this chapter we are concerned with the death loss the first few days, later losses of suckling pigs are covered in Chapter 10, "Raising Spring Pigs."

Feed lost from pig losses. If we consider the feed requirement for the sow and her litter it is evident that losses of older pigs represent more feed than losses from younger pigs.

In dividing up the losses on the basis of the age of the pigs we find that the per pig loss is:

1. 1 to 3 days old.....100 pounds concentrate feed
2. 21 days old.....150 pounds concentrate feed
3. 56 days old.....240 pounds concentrate feed

These estimates are based upon the feed required by a sow during gestation and the proportionate part of the suckling period. With a large litter the feed required is spread over more pigs and the feed per pig is lessened.

Feed for sows. For a gestation and suckling period a sow will need about 22 bushels of corn, 5 bushels of oats, and 105 pounds of protein supplement, or the equivalent. The estimates given above are for raising an average sized litter. A sow and litter will use a little more feed for a suckling period of 60 days than a sow will need for the gestation period.

Nutrition and pig losses. That nutrition is related to feeding has been demonstrated by experimental trials. Gilts on a

ration consisting of ground yellow corn, soybean oil meal, steamed bone meal, pulverized limestone, iodized salt, and concentrated cod-liver oil improved suckling performance by the addition of alfalfa pasture. This indicates that a ration which might be considered quite satisfactory can be improved. Suggested winter rations for the breeding herd are given in Chapter 7, "The Breeding Herd." It will be recalled that in the winter feeding of pregnant gilts and sows the addition of 15 per cent of good quality alfalfa hay increases the livability of the pigs.

Preliminary treatment and feeding at farrowing. With a breeding record at hand one can determine the approximate date of farrowing. (See gestation table page 121.) About one week before the predicted farrowing date the sow should be removed from the sow herd and confined to the pen in which she is to farrow. The sow will soon become accustomed to and contented with the new surroundings, but the first few days she is likely to be restless; consequently, it is never advisable to put the sow in the farrowing quarters just at farrowing time.

Feeds. The kinds of feed used are of importance. The winter ration may be continued but a bulky, laxative ration is desirable. Oats, wheat bran with a little tankage, linseed meal, alfalfa, or milk will provide the nutriment needed. Corn or other concentrated grains should be limited in amount or omitted. For 24 hours after farrowing very little feed should be given the sow. Ample water allowance is all that is desired at this time.

Getting the sow on full feed. From ten days to two weeks is the usual time suggested to get the sow back on full feed.



This is a collapsible shelter used to house a sow with her litter. The two panels hinged together make a shelter to cover a sow farrowing in the pasture.

Limited feeding is practiced until the sow is lactating normally. If the milk flow is slow in starting, use such milk-stimulating feeds as wheat bran or middlings, milk by-products, linseed meal, dehulled oats, fishmeal or tankage. Slop feeding or tempting palatable feed is considered to induce milk flow. Careful attention to both the sow and the litter immediately after farrowing is imperative. The amounts and kinds of feed are to be altered to suit individual cases. The suckling ration is to be started gradually, but by the end of ten days the ration may be largely grain plus proper supplementation.

Milk production of sows. A good brood sow will lose weight during the suckling period. A sow may lose 100 pounds in weight in farrowing and suckling. Milk from improperly fed sows is quite apt to be decreased in amount and be poor in nutrients. A poor supply of milk is one of the commonest causes of low blood sugar (hypoglycemia) in pigs less than a week old.

Causes for lack of ample milk flow. There are several factors which can bring about insufficient milk production in a herd of brood sows. If this lack is quite generally distributed in the herd, the caretaker should be suspicious of the kind and amount of feed allowed during pregnancy. In case of occurrence, he should carefully observe the herd with the following possibilities in mind:

1. Make certain the sows are fed sufficiently but are not overfed and overly fat.
2. The pregnancy ration may have been deficient in protein, mineral matter, or vitamins.
3. Light feeding after farrowing is advisable, and little corn is needed.
4. The sow may be confined for too long a time and consequently lack enough exercise.
5. Abortion disease may be present which may affect very markedly the milk flow.
6. Some sows may have milk fever.
7. There may be some inflammation quite general in the udders of the sows caused by some disease organism.

In case a sow does not start milking after farrowing a veterinarian should be called to administer milk stimulating drugs or hormones.

Disease control during farrowing. Numerous diseases, nutritional and otherwise, have their beginning in the farrowing house. It even goes back farther than that sometimes. Sows that have been properly fed will have strong healthy pigs which avoid farrowing pen ills. Then too, the sows should be disease and parasite free.

It is quite important that the newborn pig suckle soon after birth as the sows first milk contains many things needed by the newborn pig. Antibodies develop in the blood of the pigs which arise from the sows milk. Cases in which the reverse is true have been reported and will be discussed later.

On most farms the control of parasites, and filth-borne diseases is a big problem. Consequently the McLean County (Illinois) system was developed. It consists of handling young pigs from the time of birth until they are several months old in such a manner as to avoid or reduce to a minimum the chances of contamination with parasites or diseases. Young pigs are to be kept entirely away from old lots or other places that have been exposed to fecal contamination.

Several diseases and parasites can be controlled by following sanitation practices. Cleanliness of the sows, farrowing house, lots, and pastures pays off in raising pigs.

Essentials of the sanitation or McLean County system. There are four major provisions of this system which are:

1. Thorough cleaning of the farrowing pen and scrubbing with scalding water and lye.
2. Washing of the sows with warm water and soap, especially the udder, before they are put in the farrowing pen.
3. Moving to clean-ground pastures with houses that have been thoroughly cleaned and disinfected.
4. Keeping the pigs on the clean-ground pasture until they are about four months old, or weigh 100 pounds.

The need for control of swine parasites and disease is widely recognized. Pigs raised under the sanitation plan until they are



Cleaning out the farrowing pen is important. After the litter has been removed the pen is scrubbed with hot water and lye. This kills the disease organisms and the parasite eggs.

four months old and given a good start can withstand to some extent the worms and germs that they would be exposed to in the usual hog lot.

In one investigation it was found that if the system is properly followed, the system was 97.8 per cent effective in protecting pigs from parasitic and associated hog-lot diseases. About 76 per cent of the pigs farrowed were marketed. Where the sanitation system was not followed about 50 per cent of the pigs farrowed were marketed. Also the sanitation raised pigs were more efficient and ready for market sooner.

Baby-pig diseases. Even with proper feeding there may be marked death losses of young pigs. No doubt there are several causes of the so-called baby-pig disease. In many herds poor nutrition complicates the occurrence.

The pigs appear normal at birth but soon they develop unusual symptoms. Some pigs are shocked by the sows milk. Such pigs may vomit, shiver, and die in a short time. Other pigs have an unthrifty appearance, are listless, squeal (graveyard squeal), and often have yellow scours. Many die in about three day's time.

These conditions have been called baby-pig disease and three-day disease. More specifically the terms are "virus disease" and "hypoglycemia." The virus disease is due to antibodies in sows milk which are toxic to the pigs. The primary causes suspected are influenza and hog cholera. Pigs carried by the sow become sensitive and when born receive a shock from the milk antibodies. Hog cholera virus and influenza are to be avoided with

the pregnant sows. It has been suggested that pregnant sows be kept separate from the feeding pigs. Hypoglycemia is low sugar in the blood, due to a low intake or inability to use it. Glucose sugar either by feeding or injections is effective.

Management during farrowing. In addition to using good rations and following disease control measures, there are other features of management that need attention. These are discussed in the paragraphs that follow.

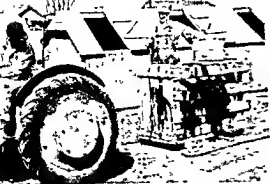
Quiet quarters. A careful herdsman can do much in making the sow contented with the farrowing pen. A little feed at the proper time, handling, or brushing will acquaint the sow with the pen and the attendant in a favorable way and she will not object to the rather limited confinement after the winter of rather unlimited range. Quiet quarters are desirable, and the herdsman who can handle the sows with the least confusion and disturbance at this time will be repaid by a larger pig crop. There is merit in solid pen partitions, especially the sides from the standpoint of quietness.

Indications of farrowing. As the time of farrowing approaches, milk comes down in the teats. This appears about 12 to 24 hours before farrowing, although in some cases the milk may be present two days before. The sow will make a nest and appear restless and uneasy as the farrowing time comes nearer.

Exercising pens. Small lots adjacent to the hog houses are needed for exercising and feeding lots for the sows. During the time that the sows are kept in the houses before farrowing, these lots can be made use of for the sows. Exercising during the day and confining to the house at night is a time-tried plan of handling the sow herd just before the pig crop comes. This will prevent constipation. After the pigs have arrived, the sows can be



The sow should be washed before farrowing. This is one of the essential steps in the McLean County system. It removes the warm eggs and disease organisms which would be passed on to the pigs.



Here we see the sow and litter being moved to clean-ground pasture. The sow is put in the crate mounted on a skid, and the pigs are put in the bushel basket on top of the crate.

turned out occasionally, provided the lots are clean and free from mud and holes. Feeding outdoors away from the pigs has many obvious advantages. The pigs should not be allowed to go in the old lots, which may be and often are the source of many swine parasites and disease germs.

Care of pigs at farrowing.

Usually farrowing takes place normally without assistance from the herdsman. Yet he should be at hand to take care of emergencies that may arise. More trouble is expected from gilts farrowing for the first time, and they require the most attention. The older sows have been saved because of their pig-producing ability and will probably give birth to succeeding litters with but little difficulty.

A sow often lies down while farrowing the entire litter; other sows get up and move about occasionally. Pigs usually come from 10 to 20 minutes apart, although this is not at all regular. In case of inability to give birth to a pig, restlessness is demonstrated and an inexperienced herdsman may need expert help in such cases.

In cold weather the herdsman should be at hand to lend assistance. The pig should be wiped off when farrowed, placed in the pig brooder or in a box or basket bedded with cloth sacks, and the box kept near a stove. Hot bricks or rocks or a jug of hot water may be placed in the box to keep the pigs warm and to dry them off. The navel cord of the newborn pig may be tied with a cord about an inch from the body and the remainder cut off, and the cut treated with tincture of iodine. It is well to let the young pig suckle as soon as possible. The colostrum milk gives the pigs some resistance power. Synthetic milks containing all the known vitamins have not been successful to date. In case a sow has more pigs than she can suckle another sow with a small litter may suckle them or they can be raised as orphan pigs.

Under favorable conditions and with good equipment very

little attention is needed. The sows will produce their young, and they will soon suckle without help.

With a sow that is not careful with her pigs or with one that has a valuable litter, it may be advisable to keep the pigs away from the sow most of the time, allowing them to suckle every two hours during the day and every three hours during the night. After a few days of this sort of treatment the pigs will be strong enough to care for themselves.

Farrowing records. In the farrowing house a record of the litter may be kept with very little attention. The necessary data worthy of record are the date of farrow, number of pigs, sex of the pigs, and ear number of marking of individual pigs. At this time the sow is to be given a definite name or herd number, and if pigs are to be recorded from the litter, the sow is to be recorded in the register association.

Litter identification. The common method of marking a litter of pigs is by ear notching. The pigs from one litter can be marked the same as the essential information concerning them is identical. This is to be done while the pigs are still very young so there is no danger of mistake.

Ear-marking systems. Generally hog men start numbering anew on January 1, and number the litters consecutively throughout the year. As the pigs become a year old and go into the breeding herd, additional means of identification, perhaps

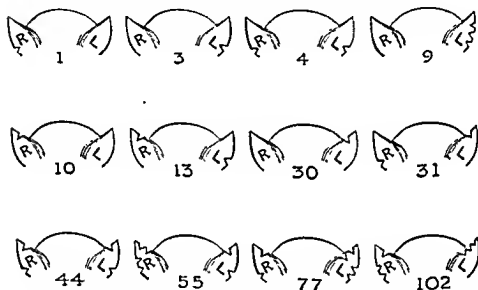


Marking the young pig involves but little time, and it establishes the identity of the pig.

ear tags, are needed, especially if several members of the same litter are retained. Large numbers are made by proper combinations. The simple systems are easier to read and are indicated in small herds.

Clipping tushes. The needle teeth, or tushes, are often removed from suckling pigs by small clippers. Their removal may

STANDARD EAR NOTCHING SYSTEM



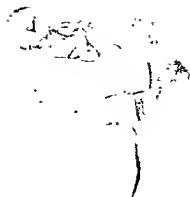
This is the standard ear-notching system.

be advisable when the pigs are damaging each other by fighting or are causing injury to the sow's udder. If there is much fighting among the pigs there may be a shortage of milk. These temporary tushes are easily cut off; however, care should be exercised in removing them as injury to the gum often results and infection may occur. Only the points are to be removed. Unless these teeth are causing trouble their removal is inadvisable.

Equipment for the farrowing house. The following articles of miscellaneous equipment are needed for use in the farrowing house in addition to those required for feeding and cleaning out litter: ear notcher, tush clipper, ear-tag punch, hog ringer, rope for snubbing, pig forceps or pig extractor, a pig box, empty sacks, tincture of iodine, ear tags, and hog and pig rings.

THE FALL FARROW- ING SEASON

The fall farrowing season is usually of less concern to the hog raiser than the spring farrowing season. A smaller number of sows are farrowing at that time and the weather conditions are more favorable. Providing sufficient feed and shelter are available for the fall



The needle teeth are removed from young pigs if necessary.

litter, hog-production costs can be reduced considerably by raising two litters annually, per sow. The greatest losses in spring pig production occur when the pigs are young, before weaning; in fall pig production the more losses occur after weaning. As a consequence, the number of pigs raised, per sow, from either spring or fall litters, is about the same but slightly in favor of the fall litters.

Sows that have been on such good forage as alfalfa, rape, or clover, during the summer, and have had plenty of exercise and an ample ration will produce favorable results from the fall farrow. If the sow herd has been neglected during the summer it is more than likely that trouble will be encountered in the fall farrowings.

Advantages of fall-farrowed pigs.

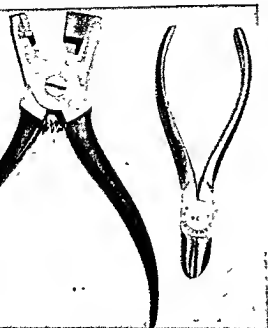
1. The cost of production is considerably reduced when two litters are produced annually from a sow and the swine equipment is used to the highest degree of efficiency.

2. Fall pigs may be sold on a more favorable market than spring pigs.

3. Fall pigs can utilize a number of feeds which may otherwise be unmarketable, such as late forage, damaged grains, milk by-products, and also pasturage of winter grain.

4. Although the labor requirement of pig raising is low, the labor involved in producing fall pigs is the highest during the months when labor is least used on the farm.

5. Fall pig raising fits in with most all types of farming.



Here is equipment for farrowing time. The clippers are for removing tushes and the punch for ear notching.

Disadvantages of raising fall pigs.

1. Forage crops cannot be used as extensively in fall pig raising as in spring pig raising.

2. Sows must farrow early-spring litters so they may be rebred for farrowing fall litters in September.

3. Additional equipment is needed for housing and caring for the fall pigs.

4. In severe winters, or long periods of damp, cold, cloudy weather, gains may be slow and expensive and losses large.

Feed, labor, and other costs compared. Fall pigs

require more feed for gain, more man labor and horse labor, and less pasture than spring pigs. This is shown in Table 11.

The average amount of labor required during two years per 100-pounds gain was 0.93 hour of man labor and 0.32 hour of horse labor for the spring pigs, and 1.43 hours man labor and 0.53 hour of horse labor for the fall pigs. Veterinary, vaccination, medicine, and other costs were 27.2 cents per 100-pounds gain for the spring pigs and 18.9 cents for the fall pigs. Other miscellaneous costs were 13.1 cents for spring pigs and 16.3 cents for fall pigs per 100-pounds gain.

Cost of gains of spring pigs and fall pigs. Studies on the comparative costs of gains of spring and fall pigs, made in Iowa and Illinois by the Department of Agriculture, indicate that the gains are more expensive on fall pigs.

The average cost of 100-pounds gain for spring pigs after weaning was \$4.76. The cost of 100-pounds gain for fall litters was \$5.81. The greater cost of gain for fall pigs was due to larger quantities of feed and labor consumed and to higher prices for

TABLE 16. AVERAGE QUANTITIES OF FEED, LABOR, AND OTHER COSTS
REQUIRED TO PRODUCE 100-POUNDS GAIN AFTER WEANING.
(U.S.D.A. Bulletin 1381D)

ITEM	2-YEAR AVERAGE	
	SPRING PIGS	FALL PIGS
Number of droves.....	77	34 ¹
Number of pounds gain.....	1,250,171	266,330 ¹
Items of cost:		
Feed:		
Corn.....pounds.....	375.8	404.8
Oats.....pounds.....	12.6	21.9
Other Grain.....pounds.....	.7	.8
Soybeans.....pounds.....	3.5	1.2
Tankage.....pounds.....	9.0	14.0
Skim-milk.....pounds.....	12.9	21.6
Other proteins.....pounds.....	2.6	.6
Mill feeds.....pounds.....	.2	1.4
Pasture: Unit days.....	3.19	1.38
Labor: Man hours....	.93	1.43
Horse hours.....	.32	.53
Veterinary.....	\$0.27	\$0.19
Other Costs.....	.13	.16

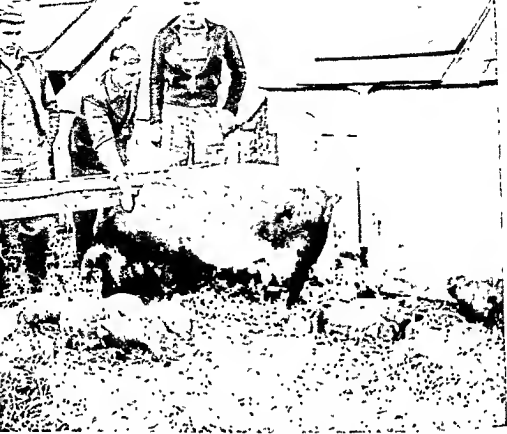
¹ Totals of droves and pounds of gain.

TABLE 17. COMPARATIVE COST OF GAINS, SPRING AND FALL PIGS

ITEMS OF COST	2-YEAR AVERAGE	
	SPRING PIGS	FALL PIGS
Number of farms.....	83	40
Pounds gain per farm.....	16,482	7,160
Operating costs:		
Feed.....	\$3.52	\$4.62
Pasture.....	.31	.12
Labor.....	.28	.41
Equipment.....	.13	.13
Veterinary.....	.25	.21
Overhead.....	.13	.16
Interest on lot and equipment.....	.14	.16
Cost of 100-pounds gain.....	\$4.76	\$5.81

feeds. The cost of producing the weanling pigs must be added to the cost of gain after weaning to secure the gross cost of producing pork.

The McLean County system of raising pigs under sanitary



Movable houses are moved up to the farmstead for farrowing. Care should be taken to provide a clean lot for the pigs. When pasture is ready the pigs are moved to it.

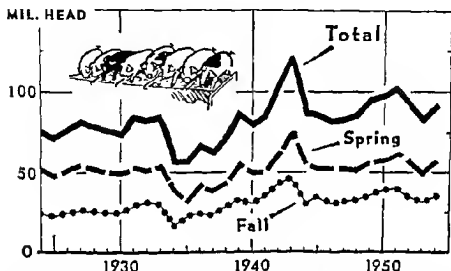
conditions is applied with equal success to the fall-farrowed pigs. A slight modification in the provisions of the system for the spring pigs is made for the case of the fall pigs. The sows that are to farrow are allowed to farrow on pasture. If they have been on a permanent pasture they should be moved to a new, clean ground pasture for farrowing.

On the clean pasture the sows farrow in movable houses. At the end of the pasture season the pigs will be past the age of greatest susceptibility to worm infection. Fall pigs farrowed rather early are old enough when confined to winter quarters that contact with contaminated ground will not seriously curb their development.

Shelter for fall farrowing. In central latitudes in usual years, farrowing in the forepart of September is the most successful. Little protection is needed then, and central houses are out of

the question as they are generally too hot to use. Movable houses, or small shedlike structures open to the south, give the shelter needed. If the central house is used for farrowing the fall pigs, the same sanitary precautions exercised with spring pigs should be followed: the pens are to be scrubbed out with hot water and

U. S. PIG CROPS



U. S. Department of Agriculture, Bureau of Agricultural Economics

The spring, fall, and total pig crops of the United States are indicated here. The proportion of fall pigs has shown some increase.

lyc, the sow washed, and the sow and pigs hauled to clean ground after farrowing.

Pasture to use. As fresh pasture is needed for clean ground and to give the fall pigs a good start, the rotation of pasture on the hog farm is an important managerial problem. A fresh field of alfalfa or a first year's growth of red clover or sweet clover in the stubble field gives the needed forage. If winter pastures are available, the pigs can be field-fed until finished. In southern latitudes, rape, rye, wheat, and oats, or combinations may be used, depending upon the local conditions.

The sow at farrowing time. The feeding and treatment of the sow at farrowing and care of the pigs at farrowing given on page 161 applies to the fall as well as the spring season.



A concrete slab for sows and litters until the posture is ready is a good plan. The movable houses are moved to the north side of the concrete slab.

Feeding the sow previous to farrowing. During the latter part of the period of pregnancy the protein supplement may be advantageously increased in amount. Most of the fetal development is towards the termination of pregnancy and the feeder should increase the ration accordingly. A heavy-milking sow needs some surplus fat, but extreme fatness is not desirable. Rations suggested under summer management can well be continued.

Feeding the sow during suckling period. After the pigs have come, increase the sow's ration and have her on full feed in two weeks' time. Full feeding may well be continued throughout the period of suckling. In fact, self-feeding may be practiced with safety. If the sow is to be rebred again for a spring litter, there will be but little time for "flushing" from the time of weaning the pigs until time for rebreeding. Liberal feeding of suckling sows pays well because they will give more milk, lose less weight, save more pigs to weaning, and will be healthier. The pigs of well-fed sows are usually larger and more uniform.

Raising fall pigs is no more difficult than raising spring pigs. Many failures made in fall pig raising are due largely to un-

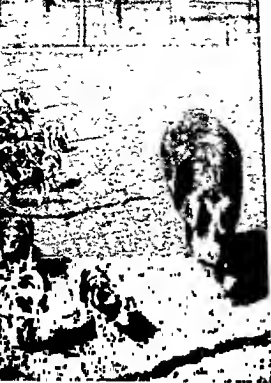


Here we see sows and litters in the farrowing house. The pen divisions have been removed, and the sows and litters are permitted to use the large pen.

sanitary conditions, incorrect rations, or lack of proper equipment. With the proper attention paid to these three essentials, fall pigs can be raised profitably on most any farm in the United States. The care of the spring pigs at farrowing time has been discussed. The same methods also hold for the handling of the fall pigs.

Essential points in the management of fall pigs. If the fall pigs are of the parentage that will give them a good start and rapid growing qualities, success is insured provided careful attention is given to the following essential points of fall pig management.

1. Shelter and housing. The house for fall pigs must be warm, dry, and well ventilated. The bedding requires much attention if many pigs are kept in one place. Fall pigs do better if handled in rather small groups. Although the quarters need to be warm and dry, ample ventilation is needed in the house.



Here we see a sow with her litter on pasture. A clean-ground pasture is a good place to start the litter.

2. *Watering.* At the Iowa Station very favorable results attended the use of heated water for fall pigs. An automatic kerosene-heated galvanized hog waterer, with a small drinking opening, proved more economical than watering in a trough. The pigs using the automatic waterer consumed more water and showed a lower feed requirement. Keeping a fresh supply of water within reach of the pig whenever his thirst demands it is one of the prime essentials. When troughs are used, water two or three times daily.

3. *Pasture.* Keep the fall pigs on pasture as long as possible. The old hog lots are to be shunned. Pasture feeding, until very adverse weather conditions prevail, is advisable because of more ideal conditions for feeding and pasture adds to the value of the ration. When pasture feeding ceases, add alfalfa meal to the ration.

4. *Exercise and sunshine.* Outdoor feeding under most conditions is beneficial. This may be due to the exercise obtained or the exposure to sunlight. Feeding outdoors requires considerably less labor in keeping the quarters clean and sanitary. In severe weather inside feeding must be followed, as the pigs will not stay outside at the feeders.

5. *Keep the quarters sanitary.* Lice, mange and other pests are spread by filthy conditions and often become quite prevalent with fall pigs. Careful attention to the sanitary conditions is needed for the control of the many destroyers of pig profits. The yards, pens, and equipment should be kept as clean as possible.

6. *Feed near the sleeping quarters.* Although outside feeding may be advantageous, it pays to have the feeders for fall pigs

near at hand and, if possible, in a sheltered place.

7. Feed a good ration. Make sure that it contains all of the essential materials for growth and fattening. Winter rations are often lacking in vitamins, mineral matter, or proteins.

8. Feed liberal quantities. There is no advantage in limiting the feed. Self-feeding is not only practical, but it is also economical. Re-

striction of feed allowance will reduce the gains and increase the feed requirement increasing production costs.

Rations for fall pigs. The same rations used for spring pigs are also satisfactory for fall pigs. However, in the absence of pasture, alfalfa meal is to be included in the ration. Fall-pig rations may be lacking in vitamins, especially vitamin A, B complex, and vitamin D. There is also more need for a mineral mixture in the winter rations for the pigs. In fact, the feeder must be more careful in the selection of the supplements for the fall pigs than in choosing the spring pigs. The forage is the safety factor for the spring pigs against lack of mineral, proteins, and vitamins. The following ration, self-fed, gives good results for fall pigs: corn complete supplemental mixture, and mineral mixture.

THE SUCKLING PERIODS

The period while sows are nursing or suckling pigs is also a critical period in the life of a pig. Good feeding and management results in larger litters of heavy pigs at weaning time. Small litters and runty pigs will result if proper attention is not given the herd at this time.

Weaning time. Pigs are weaned at any age from one week on. Under most conditions a suckling period of at least six weeks



Here pigs on pasture are being weighed at weaning time.



This pig is being weighed at weaning time on a bathroom scale. Pigs for the breeding herd should be selected from large litters of heavy weight.

is desirable. In sow testing pigs are weaned and weighed at 56 days of age. This is done to get a comparable weight for age at weaning time for comparison. See sow testing, Chapter 5. In some instances like in the two-litter system it may be necessary to wean pigs at younger ages, so that the sows can be rebred. However, pigs should not be weaned unless they are doing well and are well started on supplementary feeds.

Weights at weaning time. The weights of pigs at weaning time indicate the milk production of the sows and the gaining ability of the pigs. Since the sow is the most influential in affecting weights through this period, weighing the pigs is called

sow-testing. A good pig at 56 days of age should weigh 40 pounds and a superior pig 50 pounds.

Correcting weaning weights. As it is not always convenient to weigh pigs on the 56th day a means of weight correction is used. In Table 18 is a list of such correction factors.

To use this table find the age in days of the pig or litter and multiply the actual weight by the factor given to get the probable 56-day weight. For example if the pigs are 60 days old the weight is multiplied by .9111. If the pig weighs 50 pounds at 60 days of age the 56-day correct weight would be 45.55 pounds for 56 days.

Weaning weights related to length of feeding period. The larger pigs at weaning time get to marketable weight at younger

TABLE 18. FACTORS FOR CORRECTION OF PIG WEIGHTS TO A 56-DAY AGE BASIS

AGE	FACTOR	AGE	FACTOR	AGE	FACTOR
40	1.6400	50	1.1714	60	.9111
41	1.5769	51	1.1389	61	.8913
42	1.5185	52	1.1081	62	.8723
43	1.4643	53	1.0789	63	.8542
44	1.4138	54	1.0513	64	.8369
45	1.3667	55	1.0250	65	.8200
46	1.3226	56	1.0000	66	.8039
47	1.2812	57	.9762	67	.7885
48	1.2424	58	.9535	68	.7736
49	1.2059	59	.9318	69	.7593
				70	.7455

The factors in the table are arrived at by using the formula:

$$Y = Z \frac{41}{x - 13}$$

In this formula: Y = estimated weight
Z = actual weight
X = actual age

ages than the smaller pigs. In order to be marketed at six months of age pigs have to weigh at least 35 pounds at weaning time. Of course the rate of feeding is a factor in the gains. Pigs fed limited amounts of feed require more time to reach market weights than full-fed pigs. With the two litter a year system heavy feeding is essential, so there is little or no overlapping of pig crops. Heavy pigs at weaning time are essential for the best working out of this system.

The table from Missouri investigations given below illustrates the relation between weaning weights and rapid gains.

TABLE 19. INFLUENCE OF SIZE OF PIGS AT WEANING UPON TIME REQUIRED TO PRODUCE MARKET HOGS OF 225 POUNDS WEIGHT

WEANING WEIGHT GROUPS	NUMBER OF PIGS	AGE WHEN WEIGHT = 225 POUNDS
15-20 lbs.....	3	214 days
20-25 lbs.....	6	209 days
25-30 lbs.....	18	200 days
30-35 lbs.....	32	192 days
35-40 lbs.....	35	181 days
40-45 lbs.....	20	176 days
45-50 lbs.....	20	171 days
50-55 lbs.....	7	160 days

Pigs in the heaviest weight weaning groups gained faster thereafter and reached market weights at younger ages.

Feeding and management of the suckling sow. The same rations used during the gestation period will be quite satisfactory for the suckling period. If the ration has been adequate, the only change needed is to increase the amount. If fibrous feeds have been used and self-feeding followed, a reduction in the fibrous feeds is suggested. The ration should be such as would stimulate milk production. Some sows yielded twice as much milk as the poor producers. Sow milk is richer than cow's milk, especially in protein, fat, and ash. An excessive amount of fiber is to be avoided in suckling sow rations. Consequently alfalfa hay or meal is to be used less generously in the suckling ration than in the pregnancy ration.

Corn, oats, a supplemental mixture, and a mineral mixture will give ample variety in the suckling ration. The milk by-products are also good additions and, of course, a forage crop is imperative, sows and pigs considered.

A ration consisting of corn, oats ground or whole, a good protein supplement plus minerals and salt all self-fed will give good results. Pasture is to be used when available. Gradual changes in the ration are best, as an abrupt change may alter the composition of the milk and cause diarrhea or scours in the suckling pigs.

Amounts to feed. Heavy feeding, even self-feeding during suckling is indicated, for a good suckling sow can hardly maintain her weight while suckling even on a self-fed ration. The most serious mistake made in feeding sows during suckling is the very common practice of under feeding. Heavy feeding at the beginning of the suckling period may upset the pigs, but once the sow and pigs are well started, it is practical and economical. If the hand-feeding practice is followed, the sow may be given about four pounds of feed daily for each 100 pounds of live weight.

Pasture. Pasture is most always a part of the suckling sow's ration because of its availability at that period. Pastures when available should also be used for pregnant and open sows.

Watering. The suckling sow needs a lot of water. In one test on the water consumed, suckling sows consumed an average

of 42.7 pounds of water per sow daily. A continuous supply of good water is a prerequisite for proper suckling.

Pasture program for spring pigs. Pigs farrowed in February through March and into April are kept on dry-lot conditions until the pasture is ready. Early pasture like fall-seeded rye is most beneficial. Pigs can be moved from farrowing house and dry lots on to rye pasture early. Condition of the crop and soil and also the weather determines when the move is to be made. Sows with litters two weeks old can be shifted to pastures. Up to 12 sows and their litters can be pastured per acre. Full feeding of the grain, protein, and mineral supplements is recommended. Later when the rye is depleted other pasture is used or with the later farrowed the rye pasture is not required.

Winter wheat or oats is an excellent crop to use for this purpose in sections where it can be grown.

Pasture program for fall pigs. It is not uncommon to farrow fall pigs on pasture. The length of the pasture season determines the amount of utilization. Winter wheat, fall-seeded rye, as well as alfalfa can be used for pasture.

Paralysis in sows. Cases of paralysis are rather common when poor feeding practices are followed. The usual time for paralysis is a few weeks after farrowing, and while heavily suckling a litter. It is called "posterior paralysis" or "going down behind." This condition is brought about by insufficient amounts or improper proportions of calcium (lime) and phosphorus or a lack of vitamin D. The reserve supply of lime in the sow's bones is used by the sow to make normal milk. The control, therefore, rests upon furnishing ample calcium in the ration. Forage crops or alfalfa hay in the ration are safeguards against its occurrence. Milk, tankage, fishmeal, and bonemeal are good supplements rich in lime. A mineral mixture would be an additional safeguard against this nutritional paralysis. Cod-liver oil, because of its vitamin-D potency, is used for corrective treatment.

FEEDING AND MANAGEMENT OF PIGS TO WEANING TIME

Feeding. Pigs start to eat when they are two weeks of age. Suitable feeds should be put before them so that the eating habit is encouraged, and the gain is enhanced thereby. Such



This pig creep arrangement permits the feeding of special feed like rolled oats and pig meals.

feeds as ground corn, dehulled oats, milk by-products, or pig meals are good feeds for starting young pigs.

Creep feeding, early weaning, pig starters, and meals. Commonly a lower death loss and heavier weights of pigs at weaning time result from the use of good pig starters. For early weaning a specialized highly fortified starter feed which contains a considerable amount of dried milk plus good management is essential for success. The specialized sow's milk replacements should be fed dry.

There are many commercial pig starters on the market. The specialty feeds, even though more expensive than straight sow and pig supplement plus corn per pound of feed, generally are economical.

Pig starters should be palatable, and if intended to be complete they should be nutritionally complete. High palatable starters are pelleted or crunchy, sweet, not too fibrous, and highly fortified with vitamins and minerals. Antibiotics suitable for feeding under most conditions may be a valuable addition.

Starting pigs on a pig starter and rolled oats or broken de-



These pigs are litter mates, one with anemia and one without. The pig on the left was treated with iron in solution while nursing. The pig on the right did not receive an iron solution. The treated pig weighs 27 pounds while the untreated pig weighs 9 pounds.

hulled oats is a good practice. If early weaning is desirable, suitable sow's milk replacement feeds are available, but dry feeding is preferred.

Since the specialty feeds are high in price, shifting to a growing ration and then to shelled or ear corn or similar feed and a supplement fed either free-choice or mixed, ground, and self-fed as soon as possible, is recommended. See page 186, early weaning.

Anemia in pigs. This is a rather common condition in suckling pigs fed almost exclusively on sow's milk and confined indoors and not having contact with soil. It is a nutritional anemia. The number of red blood cells and the hemoglobin (red color) is below normal. Commonly, it occurs in pigs that are three to six weeks of age. It may result in death of the affected pigs. Early farrowed pigs kept in the farrowing house during the suckling period are subject to this disease.

Since it is due to a lack of iron and copper in the sow's milk, the control can be accomplished by feeding these materials. Some evidence indicates that the feeding of iron to sows during gestation may be helpful. There are several methods used in supplying the needed nutrients directly to the pigs.

1. Providing access to fresh clean dirt may be effective. The pigs will root in the dirt and secure a sufficient amount of iron and copper. Care is to be exercised in securing dirt that has not been contaminated with swine roundworm eggs.



These suckling pigs are working over a clod of dirt. Prevention of anemia is accomplished in many herds by feeding suckling pigs dirt.

2. Swabbing the udder of the sow with a saturated solution of copperas (ferrous sulfate) is effective. Copperas contains iron and also some copper as an impurity. To make a solution, one pound of copperas is mixed with one gallon of warm water. The udder of the sow is painted daily with this solution using a brush or a rag on the end of a stick.

3. The iron and copper may be given directly to the pigs in the form of a pill at weekly intervals. Such pills are available through veterinarians. The solution can be used for individual dosing of the pigs but this is a slow process.

4. The mixture of the iron and copper with the feed or the dirt is practiced by some. Commonly, one-tenth pound of copperas in solution is mixed with 100 pounds of feed. Control of anemia in suckling pigs has been accomplished at North Dakota Agricultural College by feeding copperas, an iron compound, to the sows during the pregnancy and suckling. A feeding of one-half ounce of copperas per sow per day, or mixing one-half pound of copperas to each 100 pounds of mixed feed for the sows is recommended.

Preventative measures like the use of dirt and swabbing the udder are suggested, and, if anemia is evident, individual treatment is resorted to. The anemic pigs can be identified by the lack of a healthy pink color in the lips, eyelids, and ears. In severe cases, the blood is straw-like in color. Affected pigs are inactive, weak, unthrifty, and lack appetite. "Thumps" or jerky breathing may be present. Anemia may cause a real set-back for these pigs and make them susceptible to other pig diseases. Runty pigs result. It is evident that if the pigs survive, they will recover from the anemia of nutritional origin when the supplementary feeding starts.

Some anemias observed in young pigs do not respond to the iron-copper treatment. Such anemias are due to disease conditions or the absence of some of the B-complex vitamins in the ration. A lack of niacin, riboflavin, or pyridoxine of the B-complex have found to be causes of anemia in pigs. Therefore, the ration for the bred sow and the starting feed for young pigs, or pig meals, should contain ample amounts of these materials. Mixed ration may be less efficient than self-feeding. A mixed ration used as a pig meal may be less efficient than self-feeding



Ohio Agricultural Experiment Station

Vitamin D prevents rickets. The pig in the top photograph is healthy and without rickets. The pig in the lower picture shows a case of rickets due to insufficient vitamin D.

ing and twisting process the attachments are separated with but little bleeding. After the removal of this testicle which requires but a short time, the one next to the operator is removed in a similar manner.

When castrating larger hogs or boars which are no longer required for breeding purposes, it is necessary to have them held securely upon their backs. It will require several men to hold a large boar for the operation, and, if they are not available, it will be necessary to tie the front and hind legs of each side securely with strong rope, if the boar is very heavy. The important point in controlling the hog is to keep the feet off the ground, holding the animal squarely on his back.

The operation is performed in the same manner as with small pigs, the only precaution to be observed being the prevention of excessive bleeding. In some instances the blood vessels of old boars become somewhat hardened and the inner coats do not wrinkle in such way as to facilitate the forming of blood clots which plug the vessels and prevent hemorrhage. Such cases would bleed freely and possibly be followed by serious results. It is advisable, there, to tie a ligature tightly around the cord before scraping through to sever the vessels. The healing process usually proceeds satisfactorily.

It is unnecessary to apply a dressing of any kind to the wounds for purposes of disinfection. In some instances it may be necessary to use applications of pine tar as a protection against flies. If the wounds become infected, it is necessary that they be treated like other infected wounds, using such disinfectants and dressings as may be indicated.

Vaccination for hog cholera. This is often done by the double treatment while the pigs are still suckling the sow. This practice, which is increasing in use, has many commendable features. It requires less serum and the pigs are much easier to handle. See Chapter 22.

RAISING ORPHAN AND EARLY WEANED PIGS

In case the sow farrowing a litter should die, fail to produce milk, or not permit her pigs to suckle, the simplest solution is to shift the pigs to some other lactating sow. Often another suckling sow is not available, and hand feeding is a necessity. It

a corn and supplement ration. The combination 70 pounds coarsely ground corn, 20 pounds coarsely ground wheat, and 10 pounds mixed protein supplement self-fed was not as satisfactory as shelled corn and mixed protein supplement self-fed separately. The mixed ration was more costly, caused greater wastage at the feeders and in value more expense in preparation in both dry-lot and pasture.

Rickets in pigs. While this condition is not manifested at as early an age as anemia, it may have its beginning during the period of suckling. Its occurrence is due to the absence or insufficient amount of the antirachitic vitamin D. This vitamin, which is the most often lacking in swine rations, controls the calcium and phosphorus equilibrium, regulates mineral metabolism, and is specific against rickets. Fall pigs are commonly afflicted with rickets, especially if weather conditions make confinement necessary for a long period.

Sunshine exposure will prevent rickets, as it acts on the pro-vitamin D in the layers of the skin and gives rise to this antirachitic substance. Forages and good-grade leafy alfalfa meal (sun-cured) are the usual feeds which, because of their vitamin D content, are corrective.

The inclusion of one pound of irradiated dry yeast per ton of feed will furnish the vitamin D₂. Dark-colored pigs will show up the deficiency sooner than white pigs. The latter will store up two times as much of this vitamin as black pigs.

Culling for castration. Boar pigs that are grades, or pure-breds not suitable for breeding purposes, ought to be castrated while still suckling the sow. In U. S. Department of Agriculture Farmers' Bulletin, 1357F, the following suggestions are given:

Age at which to castrate. The operation should be timed so that wounds are entirely healed before weaning. At such age pigs are easily handled, the operation is conveniently and successfully performed, and perfect healing of the wounds is facilitated through their being nourished and protected by the sow. Complications, with attendant stunting of growth, which sometimes happen at later ages, are not so liable to occur at this age. When the operation is allowed to go beyond weaning age, breed-

ing frequently results among the young animals of the herd.

Time for operating. Castration may be performed successfully at any season of the year. The usual seasons when sows farrow (spring and fall) establish the preferable periods when castration should be performed, namely, early summer and late fall. When possible, clear, cool days should be selected for the operation, and cold, damp weather avoided.

The preparation of pigs for castration is the same as that indicated for any other surgical treatment. A light diet for 24 hours is necessary. The digestive tract should never be distended with feed at the time of the operating.

A thorough washing of the scrotum with an antiseptic solution, such as a 2 per cent solution of liquor cresolis compositus, or cleansing with soap and water is a part of the operation which should not be neglected. Extremely irritating disinfectants should be avoided. Irritating solutions are painful to the cut surfaces and serve no useful purpose. They may cause rubbing of the wounds and so result in greater injury.

Operative procedure. An assistant should hold the pig by grasping the front and hind legs of either side with the pig's back resting on the ground and giving the pig support with his knees. These positions make it convenient for thorough washing of the scrotum and surrounding parts. Mild antiseptic solutions may be used for the final cleansing of the operative area, the hands of the operator, and the necessary instruments, in order that no infection may be transmitted to the wounded surfaces. The testicle on the side farthest from the operator is held firmly between the thumb and fingers of the left hand, while an incision is made by a single stroke of a sharp knife, parallel to the middle line of the body and about one-half inch from it. This incision should pass through the skin near the top of the testicle as it is being held and through the testicular coverings into the body of the testicle itself. The mistake is commonly made of cutting too low on the scrotum as the pig is held for the operation. Unless properly cut it is impossible for proper drainage to result when the pig is restored to its natural position. Following the incision the testicle quickly slips out from its membranes and is easily held during its complete removal. By a slow scrap-

ing frequently results among the young animals of the herd.

Time for operating. Castration may be performed successfully at any season of the year. The usual seasons when sows farrow (spring and fall) establish the preferable periods when castration should be performed, namely, early summer and late fall. When possible, clear, cool days should be selected for the operation, and cold, damp weather avoided.

The preparation of pigs for castration is the same as that indicated for any other surgical treatment. A light diet for 24 hours is necessary. The digestive tract should never be distended with feed at the time of the operating.

A thorough washing of the scrotum with an antiseptic solution, such as a 2 per cent solution of liquor cresolis compositus, or cleansing with soap and water is a part of the operation which should not be neglected. Extremely irritating disinfectants should be avoided. Irritating solutions are painful to the cut surfaces and serve no useful purpose. They may cause rubbing of the wounds and so result in greater injury.

Operative procedure. An assistant should hold the pig by grasping the front and hind legs of either side with the pig's back resting on the ground and giving the pig support with his knees. These positions make it convenient for thorough washing of the scrotum and surrounding parts. Mild antiseptic solutions may be used for the final cleansing of the operative area, the hands of the operator, and the necessary instruments, in order that no infection may be transmitted to the wounded surfaces. The testicle on the side farthest from the operator is held firmly between the thumb and fingers of the left hand, while an incision is made by a single stroke of a sharp knife, parallel to the middle line of the body and about one-half inch from it. This incision should pass through the skin near the top of the testicle as it is being held and through the testicular coverings into the body of the testicle itself. The mistake is commonly made of cutting too low on the scrotum as the pig is held for the operation. Unless properly cut it is impossible for proper drainage to result when the pig is restored to its natural position. Following the incision the testicle quickly slips out from its membranes and is easily held during its complete removal. By a slow scrap-

2. The heavy loss in weight of the sow during suckling period is avoided.

3. The pigs, being separated from the sow at a younger age, are less apt to be contaminated by diseases or parasites harbored by the sow.

4. Crushing losses of the pigs may be reduced.

5. Small litters can be weaned early and the sow marketed sooner. Litters for which a sow would not have a sufficient supply of milk will not be set back by a lack of feed.

6. The extra pigs from productive sows can be saved from malnutrition. With conditions near ideal, pigs can be weaned successfully soon after they are a week old if they have made satisfactory progress up to that age. Under usual farm conditions, weaning pigs at five or six weeks may be more successful, depending upon the circumstances. It will take young pigs 24 to 36 hours to learn to eat dry feed, and during that time they will do much squealing. An older pig may be helpful in teaching young pigs to eat.

The conditions necessary for success in early weaning are:

1. The ration is highly important as it replaces the sow's milk. A prestarter or weaner feed in pelleted form is fed up to two weeks of age. Such mixtures are highly fortified complex combinations containing a relatively large proportion of dried milk, vitamins, and antibiotics. Several pig starter feeds are available commercially. The ration is then shifted for a period from two to five weeks of age to a starter feed which is usually sugared and is highly palatable. Then a gradual shift is made to the growing and fattening ration. The specialized feeds for early weaning are expensive and may make the cost of gain higher.

2. Cleanliness and sanitation have much to do with the success of early weaning.

3. Ample space is needed. It is recommended that 6 square feet be provided per pig and not more than 10 pigs kept in one lot.

4. The pen should be dry, have solid side walls to prevent drafts, and be equipped with a heat lamp.

5. Self-feeders and waterers, with sufficient space and capacity, are needed for the pigs.

6. Disease and parasite controls are important. Suckling-pig anemia prevention is necessary. Some people advocate the administration of booster shots of hog cholera and erysipelas serum.

Much depends for the success of early weaning upon the skill of the hog raiser, and that in turn is affected by the available facilities. With the best of management and environment early weaning may be indicated, but with good hog raisers a six weeks' or longer suckling period would be advisable.

SUGGESTIONS FOR FURTHER STUDY

1. Secure bulletins on the handling of the swine breeding from agricultural experiment stations in your state and adjoining states.

2. Visit some successful swine herds in your area during the farrowing and suckling periods and determine the practices used.

3. For your locality determine what portion of the pig crop is farrowed in the spring of the year. What are the advantages and disadvantages of raising fall pigs?

4. Make a plan for an electric pig brooder and arrange to build some.

5. Determine the principal causes of pig losses in your area.

6. Arrange to visit some farm to observe the weighing of pigs at weaning time.

7. Make up some satisfactory ration for sows and pigs suitable for local conditions.

8. Arrange for a demonstration on some farm on the feeding and management of pigs including ear-marking vaccination, disease and parasite control, and castration.

9. Keep records on some breeding herd in your locality.

REFERENCES

MORRISON, F. B. *Feeds and Feeding*. The Morrison Publishing Company, Ithaca, New York.

SMITH, W. W. *Pork Production*. The Macmillan Company, New York.

United States Department of Agriculture:

Self-Feeding and Hand-Feeding Sows and Litters. Farmers' Bulletin, 1504. *Ways To Save Young Livestock*. Leaflet 1

CHAPTER 9

Raising Pigs on Dry-Lot

PIGS FROM weaning time until marketed are commonly referred to as growing and fattening pigs. In this chapter we will consider nutrient requirements for pigs, dry-lot feeding and management, and confinement or concrete-lot feeding. The raising of pigs for the breeding herd will also be included.

It is a more difficult job to raise pigs on dry-lot than on pasture. As we have more spring pigs than fall pigs and pasture is available for their use, most of our pigs are raised on pasture. Then too, hog raisers appreciate the many advantages of growing pigs on pasture.

FEED NUTRIENTS AND FEEDING STANDARDS

Terms used in regard to feeds and feeding standards. A "feeding standard" is a tabulation of animal requirements and also the nutrient allowances based on weight and in some cases on the objective of the feeding. Also included is a statement of the composition of feeds.

A "balanced ration" is one in which the nutrient supplied in the feeds allowed for 24 hours closely coincides with the stated requirement of a standard. A ration which is balanced nutritionally goes beyond the requirements of a feeding standard. It supplies all nutrients in respect to kind and amount and in a proper state of combination for all physiological processes. It must not contain injurious material in quantities sufficient to effect livestock. Such a ration is known as an adequate ration.

Nutrient. This is a term applied to a group of feed constit-

uents like protein or carbohydrates having somewhat similar characteristics that are needed in the maintenance, growth, or well-being of an animal.

"Digestible nutrients" means the amount which is apparently digested and absorbed. Very few digestion and metabolism tests have been made on swine. As a consequence digestion coefficients are secured mainly with other animals.

Crude protein is the total true protein plus the nonprotein nitrogen. The latter is sometimes designated as preformed protein. Crude protein is calculated from the nitrogen content by multiplying the nitrogen factor usually 6.25. Protein may be used by the animal for structural purposes (growth and repair) or for heat and energy.

Carbohydrate. This includes such substances as starch and sugar, which are stored in small amounts only in the animal, but are in generous quantities in plants. They are used by the animal for fat storage, heat, and energy and are made up of *nitrogen-free extract* like starch, and *crude fiber* like cellulose.

Ether extract (fat). This includes all materials that are soluble in ether, and fat and fatlike substances of high energy value. They are used by the animal for heat and energy, storage, and for some tissue building. They also affect feed palatability.

Vitamins. Vitamins are necessary for animals. A ration with the proper amount and kind of proteins, carbohydrates, fat, and inorganic material may lack in its vitamin content and, consequently, be inadequate. The vitamins affect the growth and well-being of animals. A more complete discussion of vitamins, their significance in swine rations, probable deficiencies and feed sources is in Chapter 13. The common vitamins are designated as follows:

1. *Vitamin A.* Vitamin A is often called the "butter" vitamin, and it is present in butterfat, whole milk, cheese, egg yolk, cod-liver oil, glandular organs, green pasture, green leafy vegetables, green hay, yellow corn, yellow carrots, pumpkins, and in other feeds. The ones listed are the most reliable sources. When vitamin A is absent in the ration or diet, growth ceases and there is a failure of reproduction. There may be an infection

of the eyes, and in pigs, chickens, and cattle the lack results in marked nervous symptoms characterized by impaired vision, lack of co-ordination, and spasms. This vitamin can be stored in the body at practically all ages.

2. *Vitamin B-complex.* We now recognize several members of the B-complex group. Some of which that are necessary for swine and may be lacking in rations are:

Thiamine is needed for growth, proper appetite, and strength of the legs.

Riboflavin when lacking in the ration results in slow growth, diarrhea, and nerve degeneration.

Niacin or *nicotinic acid* is a deficiency which results in pig pellagra and lowered resistance to necrotic enteritis.

Pyrodoxin when lacking results in anemia and other disturbances.

Pantothenic acid deficiency is the cause of numerous symptoms including high-stepping in swine.

Choline is needed in transporting fats and making lecithin a necessary material.

B₁₂, the animal protein factor, improves a corn, plant protein, and mineral ration.

3. *Vitamin C.* Vitamin C is known as the antiscorbutic vitamin, and it has been demonstrated as necessary for man, monkeys, and guinea pigs. It is a regulatory substance and prevents scurvy. Swine apparently can get along with no vitamin C additions to the ration.

4. *Vitamin D.* Vitamin D is known as the cod-liver oil or sunshine vitamin, or the antirachitic vitamin. It has to do with the control of the calcium and phosphorus equilibrium and exerts antirachitic effects through better utilization of calcium and phosphorus. It is stored in the body. The most reliable sources of vitamin D are cod-liver oil, legumes, whole milk, and sun-cured hay. It may be formed in the animal body by the action of ultraviolet rays on the fat just below the skin. It is very likely to be lacking in winter rations for swine, and rickets is a common condition among fall pigs confined to dry-lots and fed indoors.

5. *Vitamin E.* The absence of vitamin E may impair reproduction in animals. The most reliable sources of this vitamin are the grains, particularly the germs of grain, green-leafed vegetables, and fruits.

6. *Other vitamins.* There are several other vitamins that are essential. Under certain conditions some of these may be lacking in swine rations. We have rather incomplete information at this time on the following in swine rations: Biotin, choline, folic acid, inositol, para-amino benzoic acid, and B₁₂, or the animal protein factor.

Mineral matter or ash is the residue remaining upon burning. The mineral matter is largely lime and other inorganic elements in feeds.

Carbohydrate equivalent is the carbohydrate plus the fat. The fat is multiplied by 2.25 in order to put it on the same energy value basis as the carbohydrates.

Nutritive ratio. Nutritive ratio is an expression of the relation of the crude protein (which is used for tissue building) and the carbohydrate equivalent (which is used for heat and energy). This ratio is used to determine the suitability of a feed to certain circumstances. It may be applied to a single feed, a combination of feeds, mixture of ration, and an animal requirement. Ratios are most always determined on digestible nutrients. When determined in total nutrients it is termed *crude nutritive ratio*.

Dry matter means amount of dry substance remaining after the water has been driven off by heat.

Nutrients needed. The main uses of food are to provide (1) building or structural materials, (2) energy for work and heat for warmth, and (3) regulating materials. Food in general refers to materials which have nutritive value, while feeds are the foodstuffs used for livestock feeding.

Uses of nutrients. The nutrients are divided commonly into the proteins, carbohydrates, fats, minerals, and vitamins. The groups are not single substances nor do they provide in most cases a single need. There are several essential mineral elements

such as calcium and phosphorus, and they are not interchangeable.

The main uses of the different nutrient classes are as follows:

1. *Proteins.* These are primarily for the building and repair of the soft tissues of the body such as muscles. When consumed in excess of the needs for building and repair, proteins are used for energy or stored in the body.

2. *Carbohydrates and fats.* The main use of these nutrients is for body heat and energy. In fact the term *energy* is commonly used as one of the basic requirements rather than carbohydrates, fats, and part of the proteins. In animal feeding these nutrients are grouped under the heading of energy and the units of measurement are *therms*, while *calories* are used as the measurement units in human menus and diets. A therm is the equivalent of 1000 large calories.

3. *Minerals.* These are mainly for the growth and upkeep of the hard tissues (bones and teeth) and for the regulating body processes.

4. *Vitamins.* As vitamins too became a small part of the body, they are needed for the growth and upkeep of the body and for regulating the body processes.

Nutrient requirements may not be met because of (1) insufficient consumption, (2) inadequate absorption or utilization, or (3) increased demand. For example it will be noted that for a 100-pound pig the requirement is for 0.8 pounds protein and 3.8 pounds total digestive nutrients which would be supplied by 3.75 pounds of corn and 1.2 pounds of supplemental mixture as tankage two parts, oil meal one part, and alfalfa meal one part. The requirement has a safety margin sufficient to meet most emergencies which may occur in feeding. This margin in allowance will accommodate for usual variations in absorption, utilization, and demand. So with sufficient consumption, the nutrients would be ample in amount and kind.

Fat production. The excesses of carbohydrates, fats, and proteins are converted into fat and stored in that form on the body. This storage may be used for any of the common uses for energy, as energy for work and heat to keep the body warm. Since fat

is more concentrated than carbohydrates or protein, 2.25 pounds of these are the equivalent of one pound of fat in energy value.

Feeding standards not widely used for swine. We seldom calculate rations for swine as is done in dairy-cattle feeding. These reasons are:

1. One difficulty lies in determining accurate weight. The feeder has no very good starting point.
2. Weight changes rapidly in swine.
3. Individual feeding is seldom practiced. Hogs are most always fed in fairly large groups. The best that could be hoped for would be a herd average.
4. Because we have fairly accurate other measures of pork production the necessity of calculating rations has not been felt.
5. A rather simple ration is generally used.
6. The wide use and success of self-feeding reduces the need for ration determinations.

Feeding standards are available, and also there is the recommended nutrient allowances, both of which could be used to check the adequacy of a ration for the nutrients listed. These do not cover all the nutrients essentials.

Nutritive allowances for pigs. In the Appendix on pages 516 and 517 there is included the nutrient allowances for swine recommended by the National Research Council. Also the composition of swine feeds is given in the appendix.

Protein levels for swine. As with sows the protein levels of rations that are adequate for pigs of various weights have been determined. These are sufficient if the intake of feed is ample. In the table below are listed the suggested protein levels satisfactory with usual feeds, with ample intake, and adequate rations.

TABLE 20. SUGGESTED PROTEIN LEVELS OF RATIONS FOR PIGS

CLASS AND WEIGHT	PER CENT PROTEIN IN RATIONS
Pigs weaning to 75 pounds..	14-16
Pigs 75 to 125 pounds....	12-14
Pigs 125 to 200 pounds.....	10-12
Pigs 200 pounds and up.....	8-10

Under some conditions good pastures may reduce the proportion of protein that is needed in the remainder of the ration, as some forages are high in protein. Protein levels may be misleading because of the difference in protein quality of feeds and factors associated with quality of protein.

Protein poisoning. Concern is expressed at times regarding a high protein intake for swine and probable protein poisoning. At the Ohio station pigs were fed a 42 per cent protein ration without ill effects other than a laxative condition of the pigs. The pigs on the high protein ration gained 1.34 pounds per head daily and required 378 pounds of feed for 100 pounds gained.

Amounts of feed consumed by pigs. Fast-gaining pigs have a large capacity for feed. With balanced rations of palatable feeds the intake will be comparatively high. Seldom do we worry about how much they eat, because the self-feeding system is used. But we can check on the consumption to see if it is up to normal. If it is subnormal, the ration may be at fault or other conditions not the best for maximum consumption. Also such information may be helpful in hand-feeding if the feeding level is to approach full feeding.

Listed in Table 21 is the total feed intake on an air-dry basis for growing and fattening pigs, taken from the Recommended Nutrient Allowances of the National Research Council.

TABLE 21. TOTAL FEED INTAKE ON AN AIR-DRY BASIS FOR GROWING AND FATTENING PIGS

PIG WEIGHT	TOTAL FEED CONSUMED
	DAILY AIR-DRY BASIS
<i>Pounds</i>	<i>Pounds</i>
50	2.7
100	5.0
150	6.6
200	7.5
250	8.3

Best weight to market pigs. As pigs become older and heavier more concentrate feed is needed to produce gain. Less feed is

used to produce lean than fat. It should be pointed out that younger pigs use higher protein ration than older heavier pigs. Older heavier pigs dress higher than younger lighter pigs. The farm operator must watch the cost gain and also the market demands and balance the two factors. Heavy hogs are in demand at times, and if the feeding ratio is favorable it may be profitable to feed to heavyweights.

The U. S. Department of Agriculture made a comparison of the daily gains and feed requirement for pigs at different weights. Pigs of intermediate type were compared and self-feeding was practiced. The results are in Table 22.

TABLE 22. AVERAGE DAILY GAINS AND FEED REQUIRED FOR GAINS

PIG WEIGHTS RANGED POUNDS	AVERAGE DAILY GAINS, POUNDS	FEED REQUIRED FOR 100 POUND GAIN, POUNDS
75 to 124.....	1.62	334
125 to 174.....	1.75	380
175 to 224.....	1.71	412
225 to 274.....	1.65	446
275 to 324.....	1.46	504
325 to 374.....	1.31	552

It should be pointed out that the feed for 100 pounds gain shown in Table 22 does not include the feed eaten by the breeding herd or the feed to bring the pig up to the weight bracket which must be charged against the pig.

If the feed for the breeding herd is considered, 450 pounds of feed is required for 100 pound gains for 250-pound pigs. Thus a 250 pound pig represents about 1125 pounds of feed. This is from experiment station data. When farm survey data are included, the quantity is larger. See Chapter 20, "Feed Requirements of Swine."

It will be noted that beyond 275 pounds in weight, pigs decrease in daily gains and also require more feed for gain. Younger pigs make more economical gains than older pigs as they have less weight to maintain. However up to 300 pounds in weight there is no appreciable difference in the use of the

feed over and above maintenance. This applies to intermediate-type pigs. Small-type pigs are less efficient at heavier weights because more of the feed is converted to fat at those weights.

The following summary is given in U. S. D. A. Technical Bulletin 894 on feed for gain.

Under most conditions it is not advisable to feed the pig crop beyond the weight of 275 pounds even when feed is relatively cheap. Generally most markets give price preference for hogs about 225 pounds in weight. However when heavy hogs are scarce such may not be the case. Heavy hogs yield more lard than light hogs which influences the prices of hogs. For example in comparing 175- and 275-pound hogs, the 100 pounds of increase in weight is 57 pounds of separable fat and 25 pounds of lean meat. At the 175-pound weight the proportion of the separable fat and lean meat is about equal.

The feed-and-gain data from 12 experiments show that as the weight of hogs increases, larger quantities of feed are consumed per unit of gain, but that the increase in food consumption is less than is generally recognized. For the gain in weight between 225 and 250 pounds, 8 per cent more feed units¹ are consumed per 100 pounds of gain than are needed to bring a hog up to 225 pounds (including the feed and gain of the breeding herd). Hogs between 250 and 275 pounds consume 13 per cent more, and hogs between 275 and 300 pounds, 18 per cent more feed per 100 pounds of gain, than the 225-pound hog. These percentages refer to additional feed consumption (in feed units) for gains in weight.

Protein quality. The protein in a feed is used for body-building or energy. The latter can be stored in the body as fat, a reserve energy supply. Carbohydrate and fat from feed are also used mainly to supply energy. They are not usable for protein in the body. Consequently the ability of protein in a feed to supply that, of use to the body as such, is highly important. This is referred to as protein quality or biological value. Protein

¹The feed unit values of one pound of the principal hog feeds used in the experiment are: corn 1.00, soybean oil meal, 1.75; tankage, 2.50, and dried skim milk, 2.00.

consists of many amino acids, some of which cannot be built by the animal. A feed protein which supplies a large proportion of the essential or needed amino acids has a high protein quality. Corn proteins lack several essential amino acids; therefore to give best results it needs protein supplementation. Meat, milk, and fish proteins are very effective in supplying the amino acids deficient in corn.

It has been suggested that 1.4 per cent of protein of animal origin in the ration is ample. This would be less than 10 per cent of the protein supplement of a 15 per cent protein ration. However it should be mentioned that all is not known about the combining ability of proteins from the various plant-derived swine feeds.

Many of our rations for swine appear to be improved by animal-derived protein feeds, particularly with young pigs and under dry-lot conditions. Some of this is due in part to the animal protein factor which compensates for deficiencies in protein quality.

Animal protein factor. A quantity of animal protein appears to be necessary for maximum growth and feed utilization. Brood sows apparently require this factor to yield good-sized litters. It is apparently a water-soluble vitamin B₁₂, a whey factor, and other material which occurs with protein. Animal-derived feeds such as meat products, fish meal, and milk contain this factor in variable quantities. When soybean oil meal is used as the only supplement there is need for this factor. Cow manure contains this factor or a similar material.

Concentration of the ration. Crude fiber is a bulky material. The more fiber in a feed the less is the concentration. Concentrates like corn are distinguished from roughages like alfalfa because of the difference in fiber content.

The pig has a limited capacity of the digestion as compared with cattle and sheep. Consequently as fiber is increased in the ration, the nutrients, which are more completely used, become less. Therefore, the gain is decreased as more fibrous feeds are increased in the ration. Also the feed for gain is accordingly increased. Feed for gain is increased as the fiber content of the ration goes above 5.5 per cent. Rate of gain is adversely effected

at levels over 7.5 per cent. This applies to growing and fattening pigs. Pigs being grown for breeding can tolerate up to 10 per cent fiber without noticeable effect upon the efficiency. The reason being that they are fed limited quantities of feed.

In some cases fibrous feed are used to make less concentrated rations for self-feeding the breeding herd.

TABLE 23. CRUDE FIBER CONTENT OF SOME
COMMONLY USED SWINE FEEDS:

FEED	PER CENT CRUDE FIBER
Corn	2
Barley	4.6
Oats	10.9
Wheat middlings	6.0
Alfalfa hay	28.0
Alfalfa meal (good)	27.0

TABLE 24. THE CRUDE FIBER CONTENT OF SOME
SWINE RATIONS

	PER CENT	PER CENT CRUDE FIBER IN RATION
A. Corn.....	90	3.0
Supplement.....		
One-fourth alfalfa meal..	10	
B. Corn.....	60	4.8
Oats..... ..	30	
Tankage . . .	10	

A ration with 15 per cent alfalfa meal with feeds like corn would contain 4.7 per cent of crude fiber in the ration. A ration with 20 per cent hay of a 30 per cent alfalfa hay would contain about 8 per cent crude fiber, which could be well tolerated.

Swelling properties of feedstuffs. W. W. Smith has pointed out that bulk or volume of a feed is not the same as the volume in the stomach after wetting and soaking. Barley for example is more bulky in the digestive tract than oats. The oil meals lead the list of feeds tested in expanding on soaking with water.

Methods of feeding. Several methods of feeding are common. These are:

1. Hand-feeding means the feeding by hand, usually in a trough, one to three times a day. The scoop-shovel method, by which ear corn is shovelled to a herd of hogs on a feeding floor or dry-lot, is a form of hand-feeding.

2. Self-feeding means allowing free access to the feeds at all times.

3. Self-feeding, free-choice style means feeds are available, unmixed, at all times; for example corn, tankage, and salt may be allowed so the pigs may take what they want of any feed.

4. Self-feeding, modified free-choice style, means feeds are available; some or all may be given in mixed form, such as a ration for young pigs: corn self-fed, mixed protein supplement self-fed, and mineral mixture self-fed.

Determining efficiency of a feeding plan. When considering the effectiveness of a method of feeding, the farm operator should apply the following measures to the production:

1. Rapidity of gains including growth and fattening.
2. Feed requirement for a given gain.
3. Feed consumption daily and for the entire period.
4. Plan must be practical and simple.
5. Health must be maintained by feeding according to the plan and until the pigs are ready for market.
6. The gains produced must be of the kind desired by the pork consumer. Much fat is at present not desired. Heavy hogs are discounted in market price.
7. A system of feeding of breeding animals must also provide for normal reproduction and meet the need throughout the reproductive cycle, and it must also promote, in addition to health, long life.

Efficiency of the self-feeding system. That this system is highly efficient and superior to the hand, full-fed method is shown by the following Iowa summary involving eight separate comparisons on forage with 103 pigs weighing from 50 to 200

pounds. One of the lots was self-fed, with the same feed. The advantages in favor of the first method are listed:

Feeding days saved.....	13.
Daily gain per pig, pound.....	0.13
Feed saved per 100-pound gain, pounds.....	14.76

This system is also efficient for young pigs and well-grown shoates on dry-lot. Also it can be successful with brood sows and pigs, if proper rations are used.

LIMITED AND FULL FEEDING ON DRY-LOT

When pigs are on limited concentrate ration and ranged on forage, the pigs consume heavily of the pasture crop. In this case the forage consumed saves concentrates, also a somewhat leaner carcass is produced. If the concentrates are limited when not on pasture, a leaner carcass may result which might be produced on a lower feed requirement than a carcass with more fat. The pig fed a limited ration will gain slower and will use more feed to maintain body weight but still may have a lower feed requirement because less fat is laid down on the carcass. It will be recalled that fat has a much higher (2.25) energy value than carbohydrate and therefore requires more for its disposition than protein tissue. Also in limited feeding the utilization is slightly higher.

Pigs fed limited rations on dry-lot have lower dressing per cents and softer carcass fat than full-fed pigs. More labor is required for limited feeding because self-feeders cannot be used. Full feeding is essential to finish pigs quickly and at a young age when hog prices are high. Under usual conditions of feed prices it is advantageous to full feed the fall pigs on dry-lot. By so doing the fall crop is marketed before conflicting with the spring crop.

FINISHING PIGS ON DRY-LOT

When the forage crop has been depleted before the spring pigs have reached market weights, dry-lot finishing is necessary. If pasture is available it is economical to use it until the pigs are finished or ready for market. Two groups of pigs compared at the Ohio Agricultural Experiment Station showed a definite

advantage in favor of the use of forage during finishing period. The pigs were fed for 12 weeks on rape pasture and the ration was limited to 2.5 pounds of feed to every 100 pounds live weight. At the end of this period the pigs were full fed, one on dry-lot and one on rape forage. During the full feeding period the dry-lot fed pigs gained one-fourth of a pound less per pig per day and required 13 per cent more feed to make a unit of gain.

1. In the two years full feeding as followed in this experiment gave a greater margin over feed costs than limited feeding.

2. Full-fed pigs were ready for market in September. Limited-fed pigs will not reach the same weight until 30 or 35 days later.

3. Self-fed pigs were marketed entirely upon old corn. Limited-fed pigs will consume about 40 per cent old corn and 60 per cent new corn.

4. Alfalfa pasture increased the rate of gains and reduced the cost of gains.

5. The principal advantage of full feeding lies in the higher price at which early marketed pigs are sold. This advantage is not secured if pigs farrowed late in April or in May are full fed.

The experiments from which the above conclusions were drawn were with spring pigs self-fed in one instance and given a one-half ration in the other. Comparable lots were on alfalfa pasture. The basic ration was shelled corn, standard middlings, tankage, and minerals.

Dry-lot feeding is a common method of finishing pigs for market. When pastures have become depleted the only alternative the swine raiser has is to complete the job of finishing for market on a dry or nonpasture lot.

The student should refer to Chapters 11 and 12 for review on the various high, medium, and low protein feeds; the methods of preparing and feeding; and their relative nutritive values. Chapter 13 pertains to minerals and vitamins.

What is dry-lot feeding? A dry-lot for pigs is one in which no pasture or forage is provided. The pigs do not get any vegetation other than that included in the ration. On some experi-



This is a good layout for confinement or dry-lot feeding. Note the equipment for feeding and watering. A concrete feeding floor will help make economical gains, promoting sanitary conditions. It makes care of the hogs more convenient.

mental dry-lots the pigs do not come in contact with the soil. On farms in southern latitudes, dry-lot feeding conditions prevail but for a short period, while in the northern regions the dry-lot period of feeding may be quite long. Farm dry-lot conditions are seldom exactly comparable to experimental dry-lot conditions because the pig usually has greater range and also more opportunity to find additions to the allotted ration. Even though the feeding lot or barnyard is frozen, the pig often finds nutrient material other than the ration fed.

Why feed on dry-lot? Dry-lot feeding is seldom as advantageous as feeding on forage, but the absence of forage makes dry-lot feeding obligatory. The advantages of dry-lot feeding are the lower labor requirement other than cleaning the quarters, smaller amount of equipment needed, and the restriction of the range of the pigs. The feeder should plan a succession of forage to reduce the length of dry-lot feeding, as under usual farm conditions pasture feeding is more profitable.

Confinement feeding on concrete. Confinement feeding on concrete has been done with success by some. When practiced with proper precautions pigs can be farrowed and raised on concrete. The ration must be complete and the sanitary conditions maintained for success. For a concrete feed floor layout see Chapter 18.

Some of the conclusions from two-year comparison of concrete lots compared to pasture for growing pigs at Minnesota were:

1. There was no difference in the rates of gains of the pigs nor in the amounts of feed needed to make gains under the two plans of feeding.

2. The pigs consumed less mixed protein feed and mineral mixture on pasture than on dry-lot.

3. The pigs ate more basal concentrate (corn or substitute) on pasture.

4. One year the pigs were equally thrifty under both conditions. Three out of 25 pigs on concrete were less thrifty one year. Pasture and sunlight appeared to have a beneficial effect.

5. For the concrete confinement system about one-third more labor was required. This was for cleaning the floors and disposing of the manure.

The use of concrete will keep the pigs up out of the mud which is an advantage in many areas. Also it is easier to feed and water pigs in confinement. More labor is involved in keeping the concrete lot clean. An adaptation of this system is to use concrete around the hog house and build a concrete walk to the pastures.

A condensed buttermilk addition to a good ration for pigs on a paved-lot increased the daily gain but made no saving of feed.

How long should dry-lot feeding continue? In the central part of the country the killing frost comes about the first week in November and the pasture season opens about the beginning of May. Dry-lot feeding is resorted to during the absence of pasture, which is about six months in central latitudes.

Hogs dry-lot fed. All classes of hogs on the farm during the winter season are dry-lot fed. It is true that large pigs, such as well-grown shoates limited-fed on pasture, respond to cinnamon



Here we have a concrete lot adjoining the hog house. Good rations are necessary for success in dry-lot feeding.

rations on dry-lot better than young fall pigs. Fall pigs present the most difficult problem in dry-lot feeding because they are more dependent upon the immediate completeness of the ration. Yet fall pigs fed a superior ration make a creditable showing on dry-lot.

Pasture is highly corrective for a grain ration. At the Ohio Station it has been shown that bluegrass pasture is highly efficient in supplying the deficiencies of a grain ration consisting of white corn, middlings, linseed meal, and salt, fed to seven pigs in each lot. The results of the experiments and comments are given in Table 25.

TABLE 25. EFFECT OF PASTURE ON THE GROWTH AND HEALTH OF PIGS FED A GRAIN RATION OF WHITE CORN MEAL, MIDDINGS AND SALT

LENGTH OF EXPERIMENT, 166 DAYS	AVERAGE DAILY GAIN	CONCENTRATES FOR 100 POUNDS GAIN	MORTALITY	LAMENESS, STIFFNESS, OR PARALYSIS
	Lbs.	Lbs.	No.	No.
In dry-lot	0.65	450	3	2
On pasture	1.18	477	0	0



This is an unsanitary, muddy feed lot. Dirt lots are difficult to maintain in a sanitary condition. Filthy hog lots spread diseases and parasites. Young pigs should be kept out of old hog lots.

The pigs in dry-lot were confined to a brick-paved floor, but exposed to sunlight the same as the pigs on pasture. The pasture pigs, in addition to eating grass, rooted in the soil. This seems to have certain virtues, as attested by a separate group of pigs that had access to a dirt paddock, bare of any vegetation. As long as the pigs in this bare lot could root in and chew the dirt they thrived comparatively well, even though they received only the standard grain ration in a self-feeder. As soon as freezing weather in late fall stopped their rooting, some of them became stiff and severely paralyzed. However, the pigs on pasture, which both chewed dirt and consumed grass, had their systems well stocked with the needed nutrients, especially vitamins, and never, from start to finish, gave the least sign of malnutrition.

Difficulties in feeding on dry-lot. A grain mixture satisfactory on pasture may prove to be inefficient on dry-lot, due to any of the following conditions:

1. A lack of the right kind of proteins.
2. A lack in amount and kind of mineral matter.
3. A lack of certain vitamins, particularly A and D.

It is difficult on dry-lot to maintain sanitary conditions and to control parasites and disease. The common consequences from the feeding of grain mixtures alone, on dry-lot are listed:

1. Lack of growth or gain in weight.
2. A general unthrifty appearance.
3. Rickets.
4. Stiffness and lameness.
5. Partial paralysis of the hindquarters, or "going down behind."
6. Pneumonia, quite common in the pigs.
7. Eye infection and inflammation.
8. High death rate.

The above conditions are directly or indirectly caused by the insufficiency of the grain ration in minerals, vitamins, and proteins.

What should be added to the grain mixture on dry-lot?

1. Mineral mixture. Although there is a decided beneficial effect from adding minerals to the grain mixture, they are not sufficient. Ohio trials show the following:

TABLE 26. AVERAGE OF EXPERIMENTS, USING A TOTAL OF 56 PIGS

AVERAGE, 156 DAYS	AVERAGE DAILY GAIN POUNDS	FEED RE- QUIRED FOR 100-LBS. GAIN LBS.	MOR- TALITY NUMBER	STRENGTH OF THIGH BONES, POUNDS
Grain mixture.....	0.66	548	9	447
Ground limestone added...	1.00	454	1	1,041

The pigs in these experiments were kept in concrete or brick-paved pens. Nine of the grain-fed pigs died, in most cases from pneumonia as the immediate cause. It is known that a vitamin deficiency is a contributory factor to the onset of pneumonia. Several pigs became lame or crampy, and a few severely paralyzed in their rear quarters. The addition of two pounds of limestone to every 100 pounds of the grain mixture enabled the pigs to gain 0.34 pounds more daily, to save 94 pounds feed for every

100 pounds increase in live weight, and to escape severe stiffness or paralysis as well as lameness. The column at the extreme right in the table indicates the greatly increased strength of bone where limestone was added to this grain ration. Near the end of the tests, which averaged 156 days in length, two pigs had a staggering gait and one severe crampiness, proving that a mineral addition alone could not prevent the effects of a vitamin deficiency. The ration was low in vitamin A, which is present in relative abundance in yellow corn, butterfat, and alfalfa hay, and in great abundance in cod-liver oil. Vitamin D, in which cod-liver oil is rich and alfalfa hay relatively rich, was also lacking.

2. *Yellow corn.* Yellow corn in place of white corn will improve the grain mixture, because yellow corn will supply the necessary vitamin A. On dry-lot feeding, using only a grain mixture and minerals, the white corn is worth about 80 per cent as much as yellow corn. The pigs gain faster, require less feed for 100-lbs. gain, and remain thriftier when fed yellow corn in place of white corn. If white corn forms the main part of the ration, good alfalfa, pasture, or some vitamin carrier should be included to supply Vitamin A.

3. *Tankage or fish meal.* Two protein supplements of tankage or fish meal will improve the grain mixture because of their protein and minerals, especially the calcium (from the bones). However, both are lacking in vitamins for the best of results, and pigs fed either of these feeds with the grain mixture may show stiffness from vitamin lack.

4. *Alfalfa.* Alfalfa meal is a highly efficient corrective for the grain mixture on dry-lot, as shown by the Ohio results:

TABLE 27. ALFALFA HAY ADDED TO GRAIN RATION AVERAGE OF THREE EXPERIMENTS, USING A TOTAL OF 46 PIGS

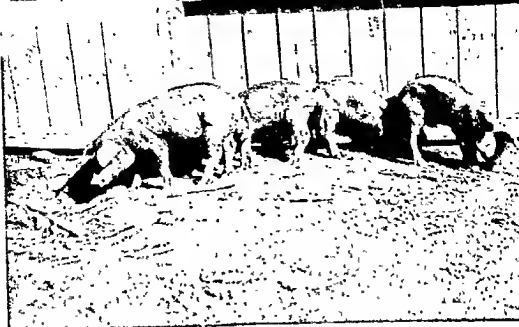
AVERAGE, 161 DAYS	AVERAGE DAILY GAIN, POUNDS	FEED REQUIRED FOR 100-POUNDS GAIN POUNDS	MORTALITY NUMBER	PARALYZED OR SEVERELY STIFF PIGS
Grain ration.....	0.51	601	11	5
Ground alfalfa hay added.....	0.91	418	0	0

Even leaving out of consideration the difference in gains and the casualty-and-cripple record, which ran into large numbers for the grain-fed pigs, and merely paying attention to the saving in feed required for 100-lbs. gain, a ton of alfalfa hay was worth \$900. Alfalfa hay showed this seemingly high value, because under the circumstances it functioned as preventive medicine. It very efficiently corrected the vitamin deficiency as well as other shortcomings of the grain mixture. Other tests have shown that the addition of 2 per cent ground limestone with about 5 per cent ground alfalfa hay to the grain ration results in an even more satisfactory mixture for growing and fattening pigs in dry-lot. About all that is needed in addition to prepare a near-ideal ration for pigs in winter is to add tankage or similar efficient animal-protein feed and possibly to substitute yellow for white corn in the mixture. Therefore, a protein-feed mixture of tankage two parts, linseed meal one part, ground alfalfa hay one part by weight, to be fed along with corn or a grain mixture, is highly efficient for pigs in the wintertime.

At the Montana Station it has been noted in dry-lot experiments that there was not a single case of failure or loss from the use of a ration of grain and alfalfa hay.

5. *Skim milk or buttermilk.* Although these two milk by-products rank high as supplements, they are not complete supplements to grain on dry-lot. Some failure will occur because of the lack of vitamin A, it being largely removed from the milk with the fat. If the ration is maintained for an extended period, pigs fed white corn and skim milk or buttermilk, or a grain mixture exclusive of yellow corn, will develop the difficulties previously described.

6. *Fish oils.* Being rich in vitamin A and vitamin D, both of which are often lacking in winter rations for swine, fish oils may prove a valuable addition to the grain ration. It prevents and cures rickets, a disease which is caused by a lack of vitamin D. However, cod-liver oil and similar fish oils vary in their vitamin potency, and when mixed with feed they are apt to lose their potency rapidly. See Chapter 13, "Vitamin Concentrates." In most cases the swine raiser must depend upon other sources of vitamins.



These pigs are infested with worms because they have been raised on old, infected hog lots.

7. Ultraviolet light irradiation. Outside feeding in winter proves more satisfactory with a straight grain ration. The short rays of the sun (ultraviolet) form vitamin D in the animal's body. Exposure to arc lamps giving off ultraviolet rays will accomplish the same end but the cost of labor of the latter is usually prohibitive.

8. Field peas. On dry-lot cull, field peas improve the grain alone ration.

9. Sugar beets. The winter ration of grain alone for pigs is improved slightly with the inclusion of sugar beets.

10. Flax seed. The cost usually prohibits the use of this feed. It apparently has but little supplemental value with a grain mixture.

11. Clover silage. One trial with medium red-clover silage as a supplement to grain in rations for pigs weighing over 100 pounds at the start gave results that were only slightly better than grain alone.

Rations for dry-lot feeding. It is quite apparent from the preceding discussion that the successful dry-lot ration must include a basal feed, a supplement or supplements containing proteins, mineral matter, and vitamins. Such a self-fed ration may

be made up as follows: corn, balanced protein supplement mixture, and complete mineral mixture. See Chapters 13 and 14 for suitable mixtures.

Further, to be successful the ration fed must be complete. That is, it must contain all of the nutrient essential. As has been noted before, a grain simple protein supplement mixture with minerals will not permit pigs to make the maximum gains.

Complete rations for pigs on dry-lot. When it is desirable not to self-feed feeds separately on dry-lot a complete ration is fed. This involves the grinding of the feeds such as corn. Also it requires shifting the proportions of the different feeds as the pigs get larger, which is necessary for economical feeding.

W. L. Robison has suggested the rations listed in Table 28 for growing and fattening pigs for the weights indicated.

TABLE 28. COMPLETE RATIONS FOR PIG ON DRY-LOT

	PER CENT OF VARIOUS FEEDS IN RATION	
	<i>For pigs under 120 lbs.</i>	<i>For pigs over 120 lbs.</i>
Corn, yellow, ground coarse.....	51.8	70.5
Wheat, ground coarse or wheat middlings. .	10	
Oats, ground fine.....	18	16
Tankage, 60 per cent protein.....	7.5	6.0
Soybean oil meal, 41 per cent protein, expeller.....	7.5	6.0
Alfalfa, ground.....	4.0	4.0
Minerals	1.2	1.5

Miscellaneous feeds used in dry-lot feeding. In addition to the feeds previously discussed, there are some miscellaneous feeds which are used.

Cow manure may improve some rations for swine. It contains the B-complex vitamins, the animal protein factor, and perhaps other nutrients. These may be helpful for rather poor rations such as corn, soybean oil meal, and minerals.

The annual report of Wisconsin Agricultural Experiment Station has the following concerning cow manure additions to rations:

In recent trials, cow manure helped most of all when used to supplement a ration made up of corn, soybean oil meal, and minerals, with no alfalfa meal. On this ration, manure reduced the amount of feed required for 100 pounds of gain from 455 to 415 pounds, and reduced the feed cost for such a gain from \$9.52 to \$8.89.

Almost as marked was the effect of cow manure in supplementing a corn-tankage ration, in this case reducing the feed requirement by 26 pounds and the feed cost by 57 cents for each 100 pounds of gain.

Cow manure failed to improve corn-soybean rations containing either 5 per cent or 15 per cent high-quality alfalfa. In both cases the feed cost was almost identically the same whether manure was used or not. The gains in weight were somewhat slower when manure was fed in addition to these amounts of alfalfa, particularly the 15 per cent level, probably because alfalfa and cow manure together supply an excessive amount of fiber.

The known facts about the value of alfalfa meal and cow manure may now be summarized as follows:

1. Growing pigs that are kept in dry-lot—meaning they are not on pasture, or else are on poor pasture with little green stuff—and depending on soybean oil meal or tankage for protein supplement will be far thriftier if they get either cow manure or liberal amounts of ground alfalfa hay.
2. If alfalfa is to furnish the B-vitamins, it had better be fed as 10 to 15 per cent of the entire ration, which is much more than most farmers have been using.
3. Growing pigs can get along without alfalfa if they follow cattle and thus have access to cow manure.
4. There seems to be no advantage in supplying both cow manure and liberal amounts of alfalfa.

Pigs following fattening cattle. Pigs following cattle pick-up the corn or other grain voided in the feces. The amount of feed voided by cattle is dependent upon the kind, amount, and form of feed fed. The age of the steers is a factor in value, as is also

the digestibility of the feeds fed. Grinding for example reduces the value of manure from cattle for feeding.

Cattle feeders prefer pigs weighing from 130 to 140 pounds to follow cattle. The usual ratio of pigs to steers when a shelled corn, corn silage, legume hay, and protein supplement for the cattle is used as follows:

2 year cattle.....	1 to 2 pigs per steer
Yearling cattle.....	1 pig per 2 steers
Calves.....	1 pig per 3 steers

About one-half to one-third of the above number of pigs are needed if ground corn is fed the cattle. Supplementary of a protein, mineral vitamin feed and hand-feeding corn are generally advisable. The pigs will recover 9 to 10 per cent of the shelled corn-fed steers on full feed. Pigs following cattle will make slower gains than comparable pigs self-fed. Results at the Iowa Station indicates, that where four hogs followed eight yearling steers being full-fed shelled corn for 166 days, pigs picked up the equivalent of 726 pounds of corn and 33 pounds of protein supplement. Therefore for each 100 pounds gained by the pigs there was a saving of 266 pounds of corn and 12.7 pounds of supplement.

Yeast. Yeast is rich in protein and the B-complex vitamins. The irradiated kind is also rich in vitamin D. Therefore, to be of value, it must be fed in rations where such deficiencies exist, and also at a level which will supply the needed nutrients.

There are several different kinds of yeast which are divided into the following general classes:

1. Irradiated dry yeast. Irradiated dry yeast is a potent source of vitamin D₂, the ergosterol form. The ergosterol is converted in vitamin D by radiation from ultraviolet lamps. Sun-cured roughages contain variable amounts of this same vitamin D₂. Irradiated yeast can be added to the feed and is used by hog feeders for fall-farrowed pigs and brood sows kept indoors. One-fourth to one pound of the irradiated dry yeast will give from per ton of feed 500 to 2000 U.S.P. units of vitamin D per pound of feed. Supplements should have about one pound per ton. Dry yeast varies in its potency depending upon the kind.

2. *Fermenting or growing yeast.* Contrary to most experiments growing yeast improved a yellow corn, soybean oil meal, and ground alfalfa ration minerals, in a series of experiments at the Ohio Agricultural Experiment Station. An ordinary yeast cake was added to the wet feed and it was allowed to work for 24 hours. Some of the wet mash was kept for a starter for the new batch of feed. Monthly the yeast was renewed. The yeast pigs were on the market 16 days earlier and required 8.9 per cent less feed for gain.



Ohio Agriculture Experiment Station

This is a pig with a severe case of rickets caused by vitamin D deficiency. Ample intake of all necessary essentials from the feed provided will prevent such deficiencies.

In a study of many experiments made by Leslie Johnson on yeast and mineralized yeast feed, he concluded it:

a. Yeast does not improve a ration in which no supplement is fed.

b. Yeast is definitely inferior as a substitute for protein supplements and probably inferior when oats or corn and oats are the concentrate fed.

c. Yeast is valueless when fed in a good ration.

In general, the conclusion has been that the use of wet yeast does not increase the gains and adds to the cost of the ration.

3. *Dried yeast.* Dried yeasts are the by-products of the brewing or distilling industry and are yeasts incapable of starting fermentation. One of these is Brewer yeast which is separated from beer, dried, and used as feed. It is high in B-complex vitamins.

The conclusions reached at State College of Washington and the use of Brewers Yeast for swine were:

From the experimental evidence to date, the value of dried yeast in swine nutrition, under average farm conditions, appears to be centered in its vitamin content. In certain areas where



This is a good sample of pigs fed out on dry-lot.

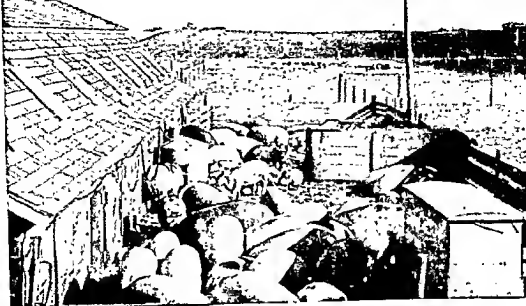
there are shortages of animal proteins, which likewise serve as vitamin carriers, the use of yeast as a vitamin source may be warranted. When plant proteins, especially soybean oil meal, are fed, there may be some beneficial effects in feeding 2.0 to 4.0 per cent of yeast in the ration as a source of some of the B-complex vitamins in which soybean oil meal is deficient.

The limiting factor in the more widespread use of yeast in swine rations is dependent on its comparative cost with other comparative protein and vitamin sources. As soon as yeast can be sold at prices similar to those of animal protein supplements, it will have a place in certain swine rations.

4. *Torula yeast.* This is a by-product of the wood-pulp paper industry which has been fed to swine, but apparently it is of no particular value in usual rations.

Infertile eggs. The infertile eggs, by-products from hatcheries, can be fed to hogs. In some species of animals the raw egg white causes a deficiency of the vitamin biotin by affecting its absorption. This may be corrected by cooking the egg. Apparently swine are not so affected with raw incubated eggs; but the condition has been produced with 30 per cent of dried egg white in the ration. See page 285.

Garbage feeding. The feeding of garbage to hogs is a profitable enterprise when properly conducted. Garbage consists of



Here we see an occasion of feeding out pigs on dry-lot after the pasture season. Many pigs are finished on dry-lot when the pasture season is over.

refuse discarded from the human food supply. When collected, garbage contains over 70 per cent of moisture. When calculated on a dry basis the protein content is about 18 per cent. There are great variations in the composition of garbage. The composition and consequent feeding value for swine varies with the season and the source. Garbage from army camps, hospitals, and institutions is the best in quality. Hotel and restaurant garbage is worth somewhat less but is superior to municipal garbage.

One ton of ordinary garbage will produce from 30 to 50 pounds of live-hog gains. The better quality garbage will give higher weight gains.

About one million hogs are garbage fed and marketed annually in the United States. There are nearly 3,000 garbage feeders that market over 100 hogs each annually. About one-half of the garbage-fed hogs are not fed any grain feed.

In the planning of a garbage-feeding establishment consideration is to be given to the following points which have to do with the success of the enterprise.

1. Value, care, and collection of the garbage
2. Location of the farm
3. Buying or raising feeder pigs



These pigs are being fed on garbage.

4. Cooking of garbage
5. Methods of feeding
6. Use of supplementary feeds
7. Space required
8. Quality of pork produced
9. Sanitary conditions
10. Disease and parasites

A detailed discussion of the above will not be given. The reader is referred to Animal Nutrition Division No. 3 revised *Feeding Garbage to Hogs* U. S. Department of Agriculture Bureau of Animal Industry, February 1943, for details. Also the state and local sanitary regulations are factors to consider.

Milorganite. Milorganite is activated sludge from sewage-disposal plants. It is used as a fertilizer. This material has failed to make good as an ingredient in swine rations.

Thiouracil. Thiouracil is a thyroid hormone inhibitor, that is, it decreases thyroid secretion. It has a tendency to slow pigs up in growth and maturing. However since it makes pigs less active it may increase efficiency if fed for short periods of time and the pigs are well grown before feeding.

Thyroprotein. Although opposite in its effect than thiouracil thyroprotein may influence efficiency of growing pigs. It tends to increase growth and maturity. So with young pigs there may be some gain in its use. It may be beneficial for both sows and

young pigs when an insufficient amount is produced by the thyroid gland.

Stilbestrol. The feeding of this synthetic sex-hormone material has no marked affect upon the rate or economy of gains with pigs. Further bred gilts can follow stilbestrol-fed steers (10 mgs. daily) without any detrimental effects.

Pigs have many nutritional diseases. Since pigs grow fast their nutritive requirements are comparatively high. Then too, pigs are often confined to small areas, reducing the possibility of supplementing the feeds given them, with feeds they might gather. Also the pig is a nonruminant and has a simple stomach. Consequently it does not have the opportunity to grow in the rumen (first stomach) by microbiological means, essential amino acids and vitamins. In most instances the lack of any of the nutrients, as in an unbalanced ration, causes a slowing down of gains. Also there is a reduction in appetite. There is included in the appendix a tabulation of some nutrient deficiencies of swine and their effects.

SUGGESTIONS FOR FURTHER STUDY

1. Visit a swine farm in your area where the confinement system of hog raising is used. Note the various practices in use.
2. Determine the profitable weights for selling hogs at your nearest market using the hog production costs and the decrease in price for heavy hogs.
3. Make a survey of hog feeding practices and determine the extent of self-feeding.
4. Visit farms where limited and full feeding are practiced. Determine the merit of the different plans.
5. Make up some complete ration for feeding pigs on dry-lot.
6. Make a list of common swine diseases in your area and indicate those which are related to feeding practices.

REFERENCES

- MORRISON, F. B. *Feeds and Feeding*. The Morrison Publishing Co., Ithaca, New York.
- SMITH, W. W. *Pork Production*. The Macmillan Company, New York.

CHAPTER 10

Raising Pigs on Pasture

IN THIS chapter the use of pastures by hogs and feed allowances on pasture will be covered. In Chapter 14 the production and management of the forage crops are discussed.

Pasture crops play a very important part in the pork-producing industry. It was formerly thought that feeding on pasture was always attended with increased gains and higher efficiency. However, such is not always the case; with a better understanding of the requirements of pigs, dry-lot rations can be made, which may equal the results obtained by pasture feeding. With good clean ground pasture hog gains may be produced on 15 to 20 per cent less concentrates. Further, the better hog pastures replace one-half of the protein concentrate. Often faster gains are made on pasture. However, in making comparisons, the difference in feeding and management are to be considered. A pasture addition may not bring much improvement with poor feeding and management. This especially if the pasture growth is not good and sanitary conditions poor.

Kind of pasture used. There has been a shift towards rotation, or tilled crop pastures in the corn belt. The popularity of the clean-ground system is responsible for a good deal of this change. Conditions vary widely, the operator to obtain best results should provide the best possible pastures suited to the situation.

A study in northern and central Indiana indicated the time spent by hogs on various kinds of pasture. These results are shown in Table 29.



These sows and litters are on pasture. By using posture, clean ground is provided, sanitary conditions improved, and parasitism and disease are curbed.

TABLE 29. TIME SPENT ON PASTURES OF DIFFERENT KINDS BY HOGS

KIND OF PASTURE	PER CENT OF TOTAL TIME SPENT ON EACH KIND
Rotation	54.2
Permanent	19.2
Woods	8.2
Stubble	5.1
Corn Stalks	6.6
Meadow after growth	6.6

It should be pointed out that the rotation pastures are preferable for pigs. Sows, boars, and stock hogs can use permanent pastures to better advantage than young pigs.

Advantages of forage crops.

1. By using pastures, clean ground is provided, sanitary conditions are improved, parasitism and disease are curbed.

2. A ration which is lacking in any of the pig's requirements shows to better advantage and more rapid gains are made on pasture than in dry-lot feeding.

3. Limited feeding can be practiced to better advantage with pigs on forage.

4. Smaller amounts of protein-rich feeds are needed to balance the ration.



Here is a layout for raising pigs on pasture. With adequate equipment in the pasture, labor can be reduced to a minimum.

5. When feeds are high in price, hogs can be carried along until the new crop is available.
6. With ample equipment forage feeding saves labor.
7. Hogs fed limited concentrates will, if allowed access to pasture, develop a greater capacity for feed.
8. Fertility of the soil is helped, the manure being distributed more uniformly over the land.
9. Elimination of noxious weeds and insects is helped.

Disadvantages of forage for swine.

1. Requires additional equipment for housing, feeding, and watering.
2. Additional fencing is needed.

Pasture versus dry-lot with a poor ration. If corn alone is used for the ration, the addition of a pasture crop greatly stimulates gains and gives a greater efficiency in feed utilization. Pigs that have not done well on dry-lot will "pick up" when turned on grass, because of the improved ration. Corn alone is greatly improved as a swine feed by feeding it with good forage.

Pasture versus dry-lot with a good ration. Even with a good ration such as corn and tankage, a pasture crop may have important bearing on the rate and economy of gain. Table 30 is a summary of trials in this respect, conducted by the Wisconsin Station, over a five-year period. The pigs were fed from an initial weight of 50 pounds up to 200 to 225 pounds. The ration consisted of shelled corn at 85 cents per bushel and tankage at \$68.90 a ton, self-fed to all groups.

The pigs on the alfalfa and rape pastures gained approximately one-fourth of a pound more per head daily compared

with the dry-lot pigs. The pigs on alfalfa needed 67 pounds less corn and 21 pounds less tankage. The returns from the pasture-fed group were also greater, exclusive of higher selling price due to their being ready for an early-fall market, or the value of the manure distributed on the land. The alfalfa and rape returned about the same amounts per acre. This was calculated by crediting the alfalfa from the lot at half the farm price of hay. The rape pasture carried, on the average 19.3 pigs per acre.

TABLE 30. PASTURE VERSUS DRY-LOT WITH A GOOD RATION

FORAGE	AVERAGE DAILY GAIN, POUNDS	FEED FOR 100-LBS. GAIN		RETURNS OVER COST OF CORN AND TANKAGE PER ACRE
		Corn, Pounds	Tankage, Pounds	
Alfalfa.....	1.31	374	21	\$92.39
Rape.....	1.30	375	23	93.05
None.....	1.05	441	42	29.72

Pasture versus dry-lot with superior ration. At the Iowa Station results indicate that with sanitary conditions properly controlled and a superior ration, the feeder may have as good results on dry-lot as on pasture, from the standpoint of rapidity of gain and feed economy. Following are the comments on one of the pasture and dry-lot comparisons:

1. The best rations in dry-lot produce as rapid gains. The 48-pound pigs getting "big ten" and corn in dry-lot took 110 days to reach the 225-pound weight; the fastest lot on rape getting fish meal and corn likewise took 110 days. On the other hand, "big ten" and corn feeding on rape required 126 days.

2. Rape pasture saves little if any corn.

3. The saving from the pasture is in the protein-vitamin-mineral supplements. Comparing the corresponding dry-lots and pasture plots whereon the same supplements were fed with corn, savings per acre were as follows:

Supplement	Pounds supplement saving
Tankage.....	1,260
Trinity mixture.....	1,751
"Big ten" mixture.....	1,353

4. The margins per pig, on the basis of feed prices charged in this experiment were greater on pasture in all four comparisons ranging from 44 cents with "big ten" to \$1.85 with tankage as the supplement.
5. In pasture feeding the manurial residues are deposited on the land where needed, without extra expense.
6. Rotated pastures should be healthier than permanent dry-lots for feeding pigs.

Forage crops saved protein supplements. A good forage crop brings a great saving in the amount of protein-rich feed, like tankage, needed to balance the ration. This is shown in the Wisconsin summary given. Alfalfa required but 21 pounds of tankage for the 100-pound gain, and rape took 23 pounds; this quantity was increased to 42 pounds per 100-pound gain under dry-lot conditions. At the Iowa Station, in a dry-lot and forage comparison, a saving of 33 pounds of tankage and 15 pounds of corn, per 100-pound gain, was affected by the use of the alfalfa forage crop.

Limiting the protein concentrate. Pigs fed a protein concentrate will make more rapid gains than those not allowed a supplement. When such supplements are high in price in comparison to corn or similar feed, it may be advisable to limit the supplement fed. If the supplement is self-fed the consumption may not be excessive, unless palatability of one of the ration components is a factor. This may apply to the basal feed, the supplement, or the forage. They may be too palatable or unpalatable. It may be economical to self-feed the supplement until the pigs weigh 75 to 125 pounds and limit that feed thereafter; commonly a ratio of one part of supplement to 20 parts of corn or substitute is sufficient.

Feeding on forage without a protein supplement. For pigs of young age it is seldom advantageous to use a basal feed alone on pasture. It is also true that well-grown shoates that have been fed a good ration may not give greatly increased gains upon the addition of a high-protein supplement. If the ration is made up of such feeds as corn or other grain, the pigs on full feed will not eat enough of the bulky forage crop to balance the ration. A high-protein supplement is practically a necessity.

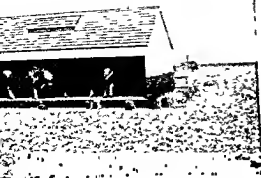


Troughs are useful for feeding and watering sows and pigs on pasture.

Six years' trials at the Purdue Station clearly showed the economy of allowing a protein supplement on legume pasture, for fattening pigs. Tankage added to corn increased the gain approximately 25 per cent, saved a little feed and shortened the feeding period 22 days. However, for pigs that are being grown and are fed a limited corn ration, there may be no advantage in allowing tankage on pasture.

Older pigs, that is beyond 75 pounds in weight, give less return from a supplement addition than younger pigs. For each pound of good supplement fed there will be a saving of two or more pounds of basal feed like corn. However, the supplement addition will usually cause the pig to gain faster. In one summarization the pigs on forage gained 17 per cent faster on 6 per cent less feed than pigs fed corn alone. Also the pasture fed pigs sold for higher prices as they were ready for market before the fall decline in hog prices.

Choice of crop for swine forage. The crops from which a selection may be made vary in their properties and none of them is ideal. Consequently, the choice must be on the basis of the adaptability of the forage to the particular needs under a given situation. If the feeder wishes an early spring pasture, fall-sown rye suggests itself. For a late-fall pasture upon which fall pigs could be farrowed, such crops as alfalfa, clover, or sweet clover could be provided. There are many forage crops and several varieties of each crop. It is essential, then, that the crop, as well



sows and pigs on pasture. Feeders with large capacity reduce the trips needed to fill the feeders. Note this feeder has a roof door for filling and the trough space is sheltered.

ommended. It is possible to forego supplement feeding for pregnant or open sows when good pasture is used. Also it is possible to get along on less than a 1 per cent ration. The judicious feeder will adjust the concentrates fed in protein content and amount to the demands of the sows. The quality and quantity of the pasture will also effect the other feeding necessary.

Pasture for sows and fall pigs. At the Michigan Agricultural Experiment Station, where the maximum use was made for brood sow and fall pigs it was estimated that one acre of pasture saved more than one ton of feed. Pasture in the fall until late and early spring is necessary to bring about such a saving. It is possible to have pasture for 9 months of the year in the northern part of the United States where fall-sown rye can be grown. The nutrients stored from the late fall pasture of rye prevented ration deficiencies in the winter dry-lot feeding period. The pasture-fed pigs gained 17 per cent faster on 15 per cent less feed than pigs fed on a concrete floor.

Value of an acre of pasture. The carrying capacity of good pasture is about 20 pigs per acre. If full feeding is practiced excellent pasture may carry from 25 to 30 pigs per acre. With limited feeding of grain the capacity would be from 15 to 18 pigs per acre. Considering the variability of pasture through the season it is well to plan on 16 to 20 pigs per acre. That is, if they are full fed and kept on pasture until marketed.

In one trial, when compared with dry-lot an acre of good al-

as the variety, should be suitable.

Pastures for brood sows. Pasture is a valuable addition to sow rations. As sows have a large capacity for feed, pasturing is advisable. During the pregnancy and open periods sows can get a large part of their feed from pasture. While sows are suckling, heavy concentrate feeding plus pasture is rec-

alfalfa pasture saved 1,620 pounds of corn and 1,020 pounds of protein concentrate. The land was capable of producing 80 bushels of corn. Further, two tons of good hay was yielded per acre. This probably would be at the upper limit of pasture value. However, if sanitary conditions are not good on dry-lot there would be an added gain obtained from the pasture. Excellent alfalfa pasture has been credited with 1,000 pounds of hog gains per acre.

Comparison of forages. Crop conditions greatly alter the kind of forage grown. Also there are seasonal differences. The distribution of rainfall through the year as well as other conditions will effect differently the yield from various forages.

W. P. Garrigus at Illinois made a study of the comparative value of different forages for swine.

Table 31 presents a summary of the results obtained from more than 100 selected, carefully controlled forage experiments conducted at eight corn-belt and adjacent experiment stations.

To facilitate ready comparison of the forages and to eliminate differences due to factors other than the forage, the results have been analyzed on a percentage basis, with alfalfa, which has proved to be the best all-round forage, given a score of 100 and the other forages given scores corresponding to the results obtained with them in comparison with those obtained on alfalfa. Although, these percentage figures are handiest for comparing one forage with another, the actual values obtained are always of interest. The average results for alfalfa are: average daily gain, 1.30 pounds; total feed per 100 pounds of gain, 370 pounds; pork produced per acre by forage alone (not counting gain produced by grain fed), 670 pounds.

TABLE 31. A COMPARISON OF PASTURE FORAGES FOR FATTENING HOGS

	AL- FALFA	RED CLOVER	SWEET CLOVER	AL- BEE	SOY- BEANS	RAPE	SUDAN	KENTUCKY BLUEGRASS
Rate of gain, per cent.	100	100	94½	88	103	99	88	86
Economy of gain, per cent. ...	100	95	93½	88	98	100	85	85
Pork per acre, per cent.	100	87	.		30	92	47	46
Average score.	100	95			77	97	74	72

¹ This rating is for first year sweet clover. After the early part of the second year the sweet clover becomes coarse, woody, and unpalatable, and its score is consequently reduced about one-half.



Sunshades are essential in pasture feeding. Temporary shades such as these can be easily erected.

evidence available indicates that the pigs on the bluegrass will gain only 86 per cent as fast as those on alfalfa, and make only 85 per cent as much gain per unit of feed.


To obtain the pork per acre score, the amount of gain which would have been produced by these pigs had the same amount of grain been fed to them in dry-lot is subtracted from the total gain made. The difference between these two figures represents the amount of pork produced per acre which can be credited to the forage consumed. On this basis the forage from one acre of Kentucky bluegrass produced each season only 46 per cent as much pork as the forage from one acre of alfalfa.

It is realized that this figure does not tell all of the story for, in the case of alfalfa, from one to two tons of good hay can be removed per acre each season in addition to the forage consumed by the pigs. Also, soybeans and sudangrass are short season crops which may be planted in June or July after the land has produced a crop of winter rye for early spring pasture.

The average scores given these eight forages represent the averages for only the three factors listed and do not take into consideration several other important points which must be considered in evaluating the different pasture crops. Two of the important factors not covered in the above comparison are average annual cost of seeding and the relative amount of protein required to produce rapid and economical gains on the different pasture forages.

It is logical to assume that pigs fattening on the legume pas-

In order that there may be no misinterpretation of this table the scores obtained by Kentucky bluegrass will be taken as an example. If two sets of similar pigs are both self-fed corn, protein supplement, and minerals with one group pastured on alfalfa and the other group pastured on Kentucky bluegrass, the evi-



Ringling of pigs, as shown above, may be needed when limited rations are fed.

tures, which are higher in protein than the nonlegumes, would require less protein supplement. In one experiment, pigs on rape (a nonlegume) consumed 40 per cent more supplement per unit of gain than did similar pigs on alfalfa pasture. Such a large difference should not be expected in most cases.

Essential qualities of a good forage. In choosing a pasture crop for swine it is necessary to take into consideration the qualities of a hog pasture, which may have a bearing on its value. The factors which affect the value of a given swine forage are enumerated.

1. Adaptability to local conditions.
2. Yield of edible pasturage per acre; neither too fibrous nor too succulent.
3. Length of pasturing period.
4. Palatability of the plants throughout the pasture.
5. A high-protein content and narrow nutritive ration.
6. A high-vitamin content.
7. Freedom from diseases and parasites harmful to swine.
8. Ability to endure trampling and grazing.



This concrete walk from the permanent hog barn to the pasture makes possible using the hog house in connection with a pasture rotation.

9. Reasonable cost of the crop seed and land preparation.

10. Adaptability to the regular farm rotation.

11. Length of time from seeding to time for pasturing.

12. Ability to be planted at several times during the growing season.

13. Constant production of high-grade forage or lack of marked seasonal variation in forage value.

14. Ability to conserve soil fertility. Leguminous characteristics are desired because of the aid in fertility maintenance.

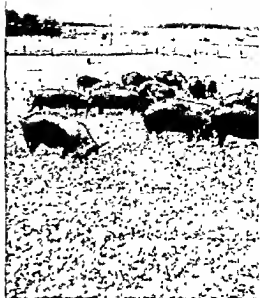
15. Perennial forages are desirable because of the saving of labor and time in growing the crop, but they are objectionable from the sanitation standpoint.

16. If the forage is also suited for hay-making this is advantageous.

Feed allowance on pasture. Full feeding of a concentrate like corn and a protein supplement will result in the greatest carrying capacity of forage. Whether to practice full feeding or limited feeding with spring pigs on pasture is a common problem. In the solution consideration is to the supply and cost of feed. Also probable selling price of the pigs is a factor. There are advantages of both systems. The following points are in favor of full feeding spring pigs.

1. There is a lower requirement for labor.
2. Risks from disease and other causes are lessened.
3. Interest on the investment is decreased.
4. The spring pigs are out of the way when the fall crop arrives.
5. In most years a greater net return is realized by this system.

Advantages of limited feeding on pasture. The feeder must consider advantages of each plan and the adaptability to his situation, in deciding which system to follow. Following are points in favor of limited feeding:



These pigs are on pasture. Many rations are improved by the addition of pasture.

1. Maximum utilization of the pasture crop.

2. Hogs so fed are better suited to hogging-down of corn, or following cattle, or for the breeding herd.

3. A smaller amount of old corn is used.

4. It fits into the general scheme of some types of farming to better advantage.

Gains made by various degrees of feeding on pasture. The following results represent the average of several experiments conducted upon this subject. It was found that:

Full-fed pigs made a daily gain of 1.46 pounds.

Three-quarter full-fed made a daily gain of 1.11 pounds.

One-half ration made a daily gain of 0.85 pound.

One-quarter ration made a daily gain of 0.45 pound.

Full-fed pigs of pasture took more concentrates than those limited in feed. However, the dry-lot period required for finishing of limited-fed pigs was more expensive from the feed standpoint than the feeding on pasture. There is seldom a justification for feeding less than a three-quarter ration.

Elimination of concentrates of forage. Attempts to put young pigs on a ration of forage alone have not been very successful, no matter how good the forage. Pigs will not maintain their weights on forage alone because of the bulky nature of the ration and their limited digestive capacity.

Cocklebur poisoning. It has been shown that young cocklebur plants may poison pigs. The young green sprouts of the cocklebur plant are the most toxic to pigs. Pigs that have consumed the cocklebur plants will become listless and will vomit. As prevention is the best practice, pig pasture should be made free from cockleburs. It is suggested that a veterinarian be called for treatment of the affected pigs. The drenching of the pigs with two or three ounces of lard, cream, or raw linseed oil in about a pint of whole milk is suggested for a home remedy.

Clay-pigeon poisoning. Pigs are susceptible to poisoning from eating some of the coal-tar pitch products. Such materials might become available to pigs in the form of clay pigeons used for trap shooting which may be poisonous even after several years of weathering. Pigs should not have access to pipes coated with pitch products.

Rooting. When fed a ration that is unsatisfactory, excessive rooting may occur. It is reduced to a minimum by feeding a suitable ration. Ringing of pigs or sows is recommended when rooting is a problem.

SUGGESTIONS FOR FURTHER STUDY

1. Make a study of the extent that pastures are used for growing and fattening pigs and sowherds.
2. List the advantages and disadvantages of the use of pasture crops for swine.
3. Make a comparison of the different pasture crops which are available in your locality.
4. Determine what saving can be made by the use of forage crops for growing and fattening pigs in your section.

REFERENCES

- MORRISON, F. B. *Feeds and Feeding*. The Morrison Publishing Co., Ithaca, New York
- SMITH, W. W. *Pork Production*. The Macmillan Co., New York

CHAPTER 11

Cereal Grains and Other Basal Feed

IN THIS chapter the swine feeds, cereal grains, and similar feeds will be discussed. These feeds commonly form the main part of the ration and consequently are termed basal feeds. The amount of such and feeds of other classes in the ration are shown by the following tabulation. If the daily ration for a 100-pound pig is considered, the consumption would be about five pounds daily which could be broken up into the following.

Corn or basal feed . . . . .	.375 pounds
Mixed protein supplement (including alfalfa meal) . . . . .	.120 pounds
Mineral mixture . . . . .	.005 pounds

Also about one gallon of water would be consumed.

The chapters that follow deal with the supplemental feeds which are so-called because they usually make up a small part of the ration. The composition of the various feeds is included in the appendix.

General characteristics of the basal feeds. Most all of the basal feeds are farm grains or the by-products of grain-manufactured products. These basal feeds such as corn have the following general characteristics of composition and consequent nutritive value which give us their use and limitations in swine rations.

1. The content of nitrogen-free extract (starch and sugar) is high, generally from 55 to 70 per cent.
2. The crude protein content is comparatively low, from 8 to 12 per cent.

3. The fat or ether extract is present usually in small quantities, usually from 1 to 5 per cent.

4. The mineral matter or ash content is low, ranging from $1\frac{1}{2}$ to 3 per cent.

5. With few exceptions, the fiber content is low, usually under 5 per cent.

6. The moisture content is generally rather low, from 10 to 20 per cent.

7. They are concentrated feeds; that is, the amount of available nutrients is high in proportion to their bulk.

8. All of them are seriously lacking in some of the essential nutritive factors; consequently are not adequate as the entire ration.

9. Although they have some supplementing value, mixtures of grain alone are usually inadequate nutritionally as a complete ration. It is therefore evident that for efficient use basal feeds must be supplemented or used in good combinations.

High and low protein grains. There may be a marked difference in the protein content of grains grown on different conditions of soil and moisture. For example in Canada it is reported that the protein content of the same variety of wheat will vary from 7 to 8 per cent in one area to as much as 16 to 17 per cent in another area. This is due to soil and moisture. Similar differences occurred in oats and barley.

Difference in composition would be reflected in the rate and economy of gain if fed in low protein combinations. If the protein supplementation is ample there probably would be little difference in high and low protein grain in feeding value.

If the protein level is adequate as it would commonly be in self-feeding free-choice style, there would be little or no difference in the response of pigs on high or low protein grains. Protein mineral and vitamin-supplement feeding is most always economical.

Corn from well or poorly managed land. Proper land fertilization will improve crop yields. Often the question comes up, is corn from well-managed land worth more than that from poorly managed land? Most evidence indicates that if a good



Pigs convert farm-grown grains and similar feeds into pork and pork products.

ration is employed which involves feeding ample protein, mineral, and vitamin supplements there would be no appreciable difference.

It has been found that the application of deficient elements to the soil increases the production first, both of the plant and grains. Most of the excesses accumulate in the leaves and stems, while the grain kernels show but a slight increase. Therefore, fertilization of a poor soil with the deficient elements would influence the composition of the forage more than grain.

Preparation of feeds. Most of the common basal or low protein feeds which are used in swine feeding are prepared by reducing the size of the particles or grinding. Crushing, rolling or cracking accomplish the same purpose. The kinds of preparation advisable is discussed under each individual feed.

The one exception to the general rule of grinding is that of corn. In this case the increase in the utilization of the corn is usually not sufficient to pay for the preparation cost. Consequently when corn is not out of line in price the increased value obtained from grinding will not pay the cost. For swine, coarse

or medium grinding of grains is preferable to fine grinding with but a few exceptions.

Rate of feeding also is a factor in the economy of grain preparation. When the method of feeding is less than full feeding by the hand method, unground grains are used more economically than at the full feeding level. On the other hand full feeding by the self-feeding method permits the pig to consume more leisurely, and mastication is more complete. In the absence of grinding facilities, self-feeding or limited hand-feeding is commonly recommended.

Hard grains too are improved more by grinding than softer grains. Yet within the range of hardness of usual dent corn it has been found that pigs from 100 to 250 pounds can use it equally well. Older pigs masticate feeds less completely than younger pigs.
dry-lot.

As unground seeds are difficult to use in mixed feeds, mixed feeds are commonly ground. This permits feeding proportions as may be desirable. Grinding and mixing are means that are available to feeders for changing the feeds naturally selected by swine.

Fineness of grinding. How fine to grind feeds for swine is a frequent question. The terms whole, coarse, medium, and fine are used to describe the degree of fineness of grinding. A more exacting measure is the modulus of fineness.

The usual recommendations as to the fineness of preparation of common swine feeds are:

Corn	.	Ear or shelled
Oats	..	Medium
Barley	.....	Medium
Wheat	.....	Medium
Rye.	.	Medium
Soybeans		Very fine

Special recommendations when necessary are made in the discussion of individual feeds.

Comparative value of basal feeds. Feeds are often compared with corn in swine feeding. These are often called corn substi-

tutes, as they are used to replace some or all of the corn in rations when the price is favorable. These relative values may be expressed in terms of *relative feeding value* for growing and fattening pigs. For example ground barley is usually worth about 90 per cent as much as corn on an equal weight basis. This is for average feeds. Following is a list of approximate comparative values. Much depends upon the quality of the feed. Heavy oats or barley are worth more per pound than light ones.

TABLE 32. VALUE OF VARIOUS FEEDS FOR SWINE

FEED	VALUE FOR HOOS PER CENT
Corn	100
Barley (ground)	90 to 95
Wheat (ground)	105
Oats (ground)	75
Oats (hulled)	140
Rye (ground)	90
Hominy feed	100
Wheat middlings (standard)	85
Wheat flour middlings	100
Milo, Kafir	90
Emmer	65
Cane seed	75
Oat feed	25-30
Molasses-cane	85
Potatoes-cooked	25
Garbage	15-20

The above values are variable. Also some of the feeds above are best when fed in limited quantities. Such feeds as hulled oats, wheat middlings, oat middlings, corn germ meal, corn oil meal, rice polish, and coconut oil meal rank high as partial substitutes for corn.

Conversion factors. Since there is a nutritional difference and a weight per bushel difference a factor considering both of these is helpful in making substitutions or deciding which is the most economical concentrate.

Explanation. To determine what a swine feeder could pay for a bushel of oats the cost of a bushel of corn is multiplied by the conversion factor. For example if corn is \$1.00 per bushel this is multiplied by .43 conversion factor for oats which gives

3. Corn is low in the amount of ash or mineral matter which it contains, compared to other feeds. Corn has about 1.2 per cent mineral matter while meatscraps or dry-rendered tankage contains 20 per cent and alfalfa hay 8 per cent.

4. Corn is short in some of the essential mineral-matter elements. Calcium, phosphorus, sodium, chlorine, and possibly other mineral elements are insufficient in corn for best results.

5. White corn has little or no vitamin A value. Yellow corn normally contains a considerable amount of carotene or provitamin A. Usually the deeper yellow in the corn the greater the potency of vitamin A, but this is not always the case. With storage the vitamin A value declines even though the color change is not marred.

6. The vitamin D potency of corn is practically nil.

7. Corn lacks in some of B-complex vitamins. Although it is fairly rich in thiamine it is lower than other grains in the niacin which may be a critical item in swine rations. Also it is low in riboflavin.

Nutritional advantages of corn. Most other basal swine feeds are compared to corn and are looked upon as corn substitutes. Corn is excellent in a swine ration nutritionally because of its high palatability for all classes of swine. Hogs make rapid and economical gains on corn plus supplement rations. Corn has a good physiological effect upon animals to which it is fed. The carcass produced on corn is very satisfactory, if not overly fat, as a white, hard fat is laid down from the corn.

Corn is easy to feed and well adapted to the self-feeding method.

Preparation of corn.

1. Ear-corn feeding is often the most economical method when it can be practiced conveniently. A wagon box can be hauled to the feeding field, or if the crib is near the feeding field it can be shoveled on a feeding floor or dry well-drained ground.

2. Shelled corn is a convenient form for self-feeding as it works better in most self-feeders. There is no benefit derived

from this practice and the question concerning its use is the increased convenience. The advantage of shelled corn over ear corn either self- or hand-fed is usually not sufficient to cover the cost of shelling.

3. Grinding increases the value slightly, especially for heavier and older hogs on full feed. For young pigs or pigs on a limited ration there is no great benefit derived if fed a good ration. In fact there may be wastage with ground corn resulting in a greater amount of feed required for a unit of gain. Under usual price conditions the increased value from grinding, where there is no wastage, is not sufficient to pay for the grinding with the exception of hard, flinty corn, even with older pigs.

4. Although corn-and-cob-meal, ground ear corn has met with favor in feeding ruminants, especially in years of high-priced roughage, it is not suited for swine feeding except for feeding in good combinations for mature sows. The great amount of fibrous material which is contained in it removes corn and cob meal from the list of desirable hog feeds, especially for growing and fattening pigs. Pigs on corn and cob meal gained 1.16 pounds per head daily while a comparable lot on ground shelled corn gained 1.46 pounds per pig daily.

5. Soaking either shelled corn or dry corn is of doubtful value under usual farm conditions and with average conditions as regards the corn and hogs.

Kinds of corn used for feeding. Several kinds of corn are used in feeding hogs. The principal ones follow, and a statement is made as to their value.

1. Dent corn is most commonly used and has the highest value under usual conditions.

2. Soft corn or immature corn on the basis of dry-matter content is as valuable as other corn. It is more difficult to store, especially in warm weather.

3. Experiments with hard and soft dent corn show that apparently there is no great difference in the nutritive value of the usual range of dent corn for growing and fattening pigs. See also page 242.

4. Flint corn when fed unprepared by grinding is of lower value than dent corn.

5. Yellow corn may be of higher value in some swine rations than white corn because of the carotene or provitamin A content. There is a loss of vitamin-A potency in yellow corn on storage.

6. White corn lacks provitamin A, but if fed on pasture or with alfalfa meal (5 per cent of the ration) it is fully equal to yellow corn.

7. Yellow corn is about 50 per cent more potent in vitamin-A activity than white-capped, yellow-dent corn.

8. Red corn with white endosperm free from yellow pigment gives the same results as white corn. Red corn with a yellow endosperm gives results approximately the same as those of yellow corn.

9. Calico corn is a variegated corn of red, yellow, white, and blue effects due to variations in color in different kernels. It is intermediate between white and yellow corn in vitamin-A content. If calico corn is selected with a yellow color it gives better results under certain conditions.

10. Some hybrid corn is harder, also lower in protein than open-pollinated. Some hybrid corns are slightly lower in value than the open-pollinated varieties.

11. While pigs prefer nonwaxy or regular to the waxy corn, experimental trials with pigs have indicated that there is no appreciable difference in feeding value.

12. Actually sweet corn is higher in digestible nutrients because of its low moisture content than usual field corn. It may be hard and require grinding for best results.

13. Corn unsuitable for popping may be used for swine feeding. Grinding is necessary because of its hardness.

14. Some of the hybrid corns have been developed for high-protein content. Average corn contains but 8.6 per cent protein. At the University of Illinois a high-protein variety contained 20.7 per cent protein. Hybrid varieties have been produced which contain much more protein than the average. Quality of protein too is a factor, for corn is low in lysine and tryptophane-essential amino acids.

Corn comparisons. It has been found that pigs will prefer some kinds of corn to others. The palatability is apparently associated with the moisture content. Pigs preferred the low-moisture content corn. However when pigs were fed only the lower palatable corns they made practically as efficient and rapid gains as pigs fed more palatable corns.

Robison conducted feeding trials with swine in which the following factors were considered. The summary was:

Pigs preferred some corns to others. Of those tried, the less palatable corn, when it was fed separately—that is, when it was the only one available—produced practically as rapid and as efficient gains as the more palatable ones. The preferences were not for open-pollinated as against hybrid corns but apparently were influenced, directly or indirectly, by the moisture content of the corns.

Consistently, a higher value was obtained for a hard-dent hybrid corn than for one that was not so hard. On an equivalent moisture basis, it showed an average worth 6.9 per cent greater a pound than the standard corn. The average amounts of moisture in the hard and softer corn as fed were 17 and 19 per cent, respectively. The advantage of the hard over the softer corn decreased as the feeding period advanced.

Flint corn which was still harder produced a trifle less, rather than more, gain per unit of feed than the standard-dent hybrid corns. As with the hard hybrid, the relative effectiveness of the flint corn decreased as the pigs became heavier.

Drying hard-dent hybrid corn to summer dryness, or an average of 10.3 per cent of moisture, apparently did not reduce its palatability but lowered its effectiveness or feeding value. Its average worth was 93 per cent that of the standard and 88 per cent that of the undried hard corn.

Immature corn, that was kept from molding by drying, was worth fully as much, per pound of dry matter contained, as was mature corn. The loss from late planted or immature corn, that is kept without spoiling, is in a reduced yield of grain, on a dry-matter basis, per acre rather than in a lowered feeding value, per pound of dry matter produced.

On an equivalent moisture basis, except when molded, the long-season or late-maturing corn, like the immature corn, showed a feeding value as high as that of the standard corn.

Freezing did not impair the nutritive value of immature corn.

Molded corn was worth 88.7 per cent as much a pound, on an equivalent moisture basis, as sound corn. Doubtless the worth of moldy corn varies with its condition.

As the pigs, which were self-fed shelled corn and supplement separately, became heavier they gained more rapidly and took less supplement in relation to the corn consumed but required more feed per unit of gain produced.

Soft-corn feeding trials at South Dakota. In the winter feeding trials it was found that 100 pounds of hard-ear corn was the equivalent of 130 pounds of soft ear corn plus one-half pound of protein supplement. The soft corn fed during the spring and summer months was worth less because of deterioration. In this latter case 100 pounds of hard-ear corn was worth 142 pounds of soft-ear corn plus 11.5 pounds of protein supplement. In the two years tests were made, the moisture content was 25 and 32 per cent. The hard corn was No. 3 grade.

The pigs made rapid and efficient gain on the soft corn during the winter. Soft corn can be fed without special preparation such as drying, salting, shelling, crushing, or grinding. Although soft corn can be piled on the ground and fed successfully during the winter, drying in narrow cribs or other means is advisable if it is to be kept during warm weather.

Moldy corn. There may be many degrees of moldiness in corn. The extent of mold would be a factor in the nutritive value of moldy corn. Slower gains result with moldy corn. Illinois results indicated that moldy corn is worth 68 per cent the value of sound corn. In the Ohio work it had a value of about 89 per cent that of sound corn. However, such corn appears to be safe to feed.

Corn grades. The grades of corn No. 2, No. 3, and sample grades of yellow corn were tested for growing and fattening pigs at the Minnesota Agricultural Experiment Station. The

differences in rates of gain were not significant. Also there were no differences in the amount of feed for a unit of gain.

Tankage supplements corn on dry-lot. A standard for comparison in swine experimental work was the corn and tankage ration, self-feeding, free-choice system. Although this ration is now known not ideal, it may be timely to show the value of the tankage as a corn supplement.

The young pigs averaged 69 pounds at the start of seven trials. Twenty-two trials are included in the summary for older pigs, which averaged 136 pounds at the start.

TABLE 34. CORN ALONE VERSUS CORN AND TANKAGE FOR GROWING, FATTENING PIGS¹

AVERAGE RATION	AVERAGE LENGTH OF TRIALS, DAYS	DAILY GAIN, POUNDS	FEED FOR 100 POUNDS GAIN	
			Corn, Pounds	Tankage, Pounds
Trials with young pigs				
Lot I, corn alone	122	0.59	642	...
Corn 3.5 lbs.....				
Lot II, corn and tankage	122	1.18	387	42
Corn 4.4 lbs. Tankage 0.48 lbs.....				
Trials with older pigs				
Lot I, corn alone	78	0.97	628	...
Corn 5.4 lbs.				
Lot II, corn and tankage	78	1.56	402	43
Corn 6 0 lbs. Tankage 0 65 lbs. .				

¹ MORTON, *Feeds and Feeding*

In both comparisons the daily gain was increased and the daily ration increased, and the feed for gain was lessened by adding the tankage.

One pound of tankage saved about 6.1 pounds of corn for younger pigs and 5.4 pounds for older pigs when it is used to supplement corn on dry-lot in comparison with no supplementation.

Tankage supplementation of corn on pasture. Good forage reduced partially the need for other supplementation. On an

excellent forage like alfalfa more rapid gain can be expected when a supplement like tankage is added to the corn ration, and there is also a decrease in the feed requirement. Many factors would influence the effect of the tankage addition to corn on pasture. These factors might be the age and weight of the pigs, previous feeding of the pigs, length of feeding on the pasture, and the kind and nature of the forage.

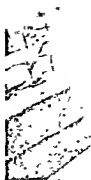
Other supplements. Tankage has been the protein-rich supplement mentioned so far as an improvement to the basal ration or corn. There are many other feeds of this nature, as noted in the classes of feeds, and any one or combination of them may be economical and satisfactory to use under certain circumstances.

Getting the most out of corn. It is evident that to get the most out of corn fed to pigs, good rations, including a mineral mixture, should be used. It is effective to use other grains such as oats, along with corn when economical, and also pasture crops.

Tabulated in Table 35 is a summary made at the Iowa State College which illustrates how to use corn efficiently for growing and fattening pigs.

Hominy feed. This corn by-product is obtained in the manufacture of pearl hominy, or hominy grits and table corn meal by the degerminated process. Hominy feed is made of the offal from this process and is composed of a mixture of the bran, the germ, and some of the starchy part of the corn kernel. The germ is usually pressed to remove part of the oil prior to mixing in hominy feed. It is often kiln-dried so it can be safely stored. In composition it is higher in protein fat and fiber than corn.

Compared with corn for feeding, it is about equal in value. Pigs on rations with a basis of hominy feed usually gain a little slower, but require less protein supplement than pigs with corn for a basal feed. In comparisons between hominy feed and shelled corn there is usually but little difference in the amount



Grains like corn need supplementation. This pig has rickets caused by a ration too low in lime (calcium).

TABLE 35. GETTING THE MOST OUT OF CORN FOR GROWING AND FATTENING PIGS

PART I

IN DRY-LOT		
Self-fed rations	Daily gain in pounds	Pounds feed for 100 pounds gain
Corn.....	.59	642
Corn.....		387
Tankage.....	1.18	42
Corn (ground) 75 }		315
Oats (ground) 25 }	1.44	105
Tankage.....		42
Corn.....		334
Meat and bone meal 40 }		
Soybean oil meal 50 }		47
Alfalfa meal 10 }	1.57	

PART II

ON PASTURE		
Self-fed rations	Daily gain in pounds	Pounds feed for 100 pounds gain
Corn.....	1.29	352
Corn.....	1.47	314
Tankage.....		23.1
Corn (ground) 75 }		252.8
Oats (ground) 25 }	1.66	84.3
Tankage 8 }		27.
Corn.....		318
Meat and bone meal 50 }		
Soybean oil meal 50 }	1.68	37.7

of feed for gain. Yellow hominy feed contains more of vitamin A than white hominy feed; consequently, in rations deficient in this material it is to be preferred.

Oats. Because of the higher fiber content this grain is not highly suited for the sole basal concentrate for growing and fat-



This self-feeder is stocked with alfalfa hay. Alfalfa hay supplies many of the deficiencies of a grain ration.

tening pigs. It is less palatable than corn. However, it is excellent for brood sows, young pigs, pigs that are fed limited rations, and for fattening pigs in limited amounts. Oats are variable in value, depending upon the amount of hull. Heavy oats are of the highest value. The protein in oats is of greater value for pigs than the protein from corn. Oats treated for seed is not a safe feed for pigs.

Effect of fiber on the ration efficiency. A ration with 30 per cent of average oats with corn and tankage will have nearly 5 per cent of fiber. Above this level there will be a reduction in efficiency of the ration. If alfalfa hay is added at a 5 per cent level to the above ration for growing and fattening pigs, the feed consumption for gain would go up and the gains slow down. Such a ration would contain 5.8 per cent of fiber. Adding 15 per cent of alfalfa hay to a ration with 30 per cent of oats would definitely slow down the gains and increase the feed required for gain. However, if oats are relatively cheap it may be economical to use it at higher levels.

Oats in rations for growing pigs. With limited-rations feed for growing pigs, oats may have a higher value than in the fattening ration. However, at the Minnesota Station it was found that

the substitution of oats for corn in the limited ration, decreased the rate of gain, increased in the feed requirement for gain, and also increased the cost of the gains.

Oats for growing and fattening pigs. On full-feed rations too much oats is a decided disadvantage. However, a very small amount has in many cases improved the corn, supplemental mixture, mineral mixture ration. For this purpose whole oats when self-fed separately usually are of more value than ground oats. If more than 10 per cent of oats is to be fed it should be ground. Ground oats will for example help a ground corn, soybean oil meal, ground alfalfa, minerals ration on dry-lot, but not as much as meat scraps or linseed and cottonseed meal.

Fineness of grinding oats. A summary of feeding trial from the Purdue Agricultural Experiment Station indicates that medium-ground oats are superior for growing and fattening pigs. In these trials oats made up one-fourth of the total ration: The results follow:

TABLE 36. FINENESS OF GRINDING OATS FOR GROWING AND FATTENING PIGS

OAT PREPARATION	WHOLE	COARSE GROUND	MEDIUM GROUND	FINE GROUND
Average daily gain pounds.....	.82	1.01	1.11	1.05
Feed for 100 pound gain pounds..	494.2	442.1	416.2	446.5
Comparison of the cost of gains with medium ground oats at 100 per cent.....	100	105	118	108

It will be noted that medium fineness ground oats gave better results than whole, coarse-, or fine-ground oats. Coarse-ground oats excelled fine-ground oats. Finely-ground oats may be consumed in larger proportion than coarsely-ground oats.

Soaking oats. When ground oats is the principal ingredient of the ration there is some advantage in soaking the oats in water for 24 hours before feeding. This requires self-feed.



This picture shows pigs on concrete having access to self-feeders including corn, protein supplement, alfalfa, and minerals.

Oat kernels made up 29.4 per cent of the ration in which it was used. The pigs getting oat kernels gained a little faster and required less supplement. In determining the replacement value, 100 pounds of oat kernels replaced 104 pounds of corn, 17 pounds of supplement, or a total of 121 pounds of feed.

Oatmeal. Oatmeal is quite widely used as a starting feed for young pigs.

Barley. Barley is second only to corn in the extent of its usage, and it is estimated that about 60 per cent of the barley fed in the United States is fed to hogs. In regions where corn is not grown, as in parts of Canada and in northern and western states, it makes the chief basal feed. Barley with alfalfa has been found to be a profitable combination. It is also used extensively in Europe for swine feeding. Barley is highly regarded as a feed for bacon hogs when supplemented with milk. This combination is commonly used in bacon-producing districts.

Barley compared with corn. In many feeding trials, comparisons have been made of barley and corn. Usually the latter proves to be superior, although this is not always the case. The following summary of eight trials on dry-lot brings out the comparative value of the two feeds for hogs. The pigs averaged 79 pounds at the start and were self-fed for 75 days.

TABLE 38. GROUND BARLEY VERSUS CORN FOR FATTENING PIGS ¹

	AVERAGE RATION	DAILY GAIN	FEED FOR 100 POUNDS GAIN	
			Grain	Tankage
Lot I.....	Ground barley 6.6 lbs. Supplement 0.4 lb.	1.55	428	27
Lot II.....	Corn 6.2 lbs. Supplement 0.6 lb.	1.66	373	36

¹ Morrison, *Feeds and Feeding*.

With corn at 56 cents and supplement at 50 dollars, ground barley is worth 93 per cent as much per pound as corn. Pigs gain faster on less feed with heavy barley than with lighter barley.

Barley should be ground or crushed. The degree of fineness of grinding is not a factor in the rate or feed needed for a given gain but fine grinding requires more power and is therefore more costly. This considered, it is worth about 80 to 85 per cent as much as corn, pound for pound. In fact some barley may be enhanced 25 per cent in value in grinding for hogs. Soaking will not take the place of grinding.

The superiority of corn is due to the smaller fiber content. Both of these feeds have somewhat the same deficiencies and require supplements. Barley is suited for all classes of hogs. Corn, however, is higher in palatability, better for young pigs, and will put on a higher finish.

Hulless barley. Because of its lack of fiber, hulless barley is of higher value than regular barley. It is about equivalent to corn on a weight basis when it is prepared by grinding.

Scabbed barley. The parasite which causes this condition lives over the winter in the crop residues, spread to the develop-

Barley compared with corn. In many feeding trials, comparisons have been made of barley and corn. Usually the latter proves to be superior, although this is not always the case. The following summary of eight trials on dry-lot brings out the comparative value of the two feeds for hogs. The pigs averaged 79 pounds at the start and were self-fed for 75 days.

TABLE 38. GROUND BARLEY VERSUS CORN FOR FATTENING PIGS ¹

	AVERAGE RATION	DAILY GAIN	FEED FOR 100 POUNDS GAIN	
			Grain	Tankage
Lot I.....	Ground barley 6.6 lbs. Supplement 0.4 lb.	1.55	428	27
Lot II.....	Corn 6.2 lbs. Supplement 0.6 lb.	1.66	373	36

¹ Morrison, *Feeds and Feeding*.

With corn at 56 cents and supplement at 60 dollars, ground barley is worth 93 per cent as much per pound as corn. Pigs gain faster on less feed with heavy barley than with lighter barley.

Barley should be ground or crushed. The degree of fineness of grinding is not a factor in the rate or feed needed for a given gain but fine grinding requires more power and is therefore more costly. This considered, it is worth about 80 to 85 per cent as much as corn, pound for pound. In fact some barley may be enhanced 25 per cent in value in grinding for hogs. Soaking will not take the place of grinding.

The superiority of corn is due to the smaller fiber content. Both of these feeds have somewhat the same deficiencies and require supplements. Barley is suited for all classes of hogs. Corn, however, is higher in palatability, better for young pigs, and will put on a higher finish.

Hulless barley. Because of its lack of fiber, hulless barley is of higher value than regular barley. It is about equivalent to corn on a weight basis when it is prepared by grinding.

Scabbed barley. The parasite which causes this condition lives over the winter in the crop residues, spread to the develop-

ing barley or wheat kernels in humid, hot weather, and causes the scab disease. The scab causes lightweight kernels of poor quality with lowered feeding value, especially for pigs. At the Wisconsin Station it was found when 60 per cent of badly scabbed barley was used in a dry-lot feeding mixture, pigs vomited when started on feed and did not eat enough to maintain their weight. The pigs were very sensitive to mixtures of scabbed barley and sound grain, as less than 30 per cent was sufficient to make them lose weight. The amount that can be used depends upon the amount of infestation in the barley and the ration in which it is used. In a good ration one part of scabbed barley with eight to ten parts of other grain should be satisfactory. For poultry the scabbed barley gives essentially the same results as normal barley. Also it is apparently not injurious to cattle or sheep. Ergot has been reported in barley which should be avoided in large quantities in swine rations.

Wheat. Seldom is wheat, of good quality, available at prices which would enable hog feeders to use it profitably. It is primarily a food for human consumption and when in surplus for this use, poultry feeders outbid the hog feeders for the supply. However, many of the wheat by-products are used for swine feeding. Damaged or immature wheat is often used; it is unsuited for milling and is therefore in the usual form and available for livestock feeding. If it is as cheap as corn, pound for pound, and not noticeably deficient in quality it is economical as a swine feed. Frozen or immature wheat has at times been suspected as the source of some material toxic to swine. This is due to feeding in a poor ration rather than to the presence of poisonous material.

Comparative value of wheat. Good wheat is equal to, or slightly superior to corn for growing and fattening pigs. Wheat may be more palatable than corn, also requires less protein supplementation and pigs on wheat may gain slightly faster than pigs on corn. The pork produced on wheat is firmer than corn-fed pork. It is, however, necessary to prepare wheat by grinding to obtain the best results. Grinding will increase the value of wheat 15 to 20 per cent when hand-feeding is practiced. With self-feeding there is less difference. It is to be remembered that wheat has about the same deficiencies as corn.

Rye. In composition, rye is quite similar to wheat. In value for swine feeding its worth is considerably less. As a basal feed it is inferior to corn, wheat, and barley, and if it is to be used it should be as a partial replacement for one of these other basal feeds rather than as the entire ration. Conflicting results have been obtained from the use of rye. It is usually considered to be 90 per cent as efficient as corn on the equal weight basis. This is assuming good-quality rye and an absence of ergot. It was found that the clean rye easily excelled from all standpoints the unclean rye. The ergoty rye was worth 92 per cent as much as the pure rye. The inferiority of rye is thought to be due to its ergot infestation and most samples tested carry some ergot. At the Minnesota Station it was found that 0.1 per cent ergot in rye was so unpalatable for pigs and rats so as to retard consumption. One per cent ergot in rye was so unpalatable that rats would starve rather than eat it.

How to feed rye. There is much difference in rye; the section in which it is grown, climatic condition, and the presence or absence of ergot, and other parasitic conditions alter its value. The amount in the ration is to be limited. Under dry-lot conditions perhaps 20 per cent of the ration is the maximum allowance for long feeding periods. For best results from rye it should be fed on good forage. Rye is not improved by cooking, and the addition of material high in vitamins A and D is apparently of no avail. A mineral mixture bearing an iron compound brings about slight improvement. When rye costs 90 per cent as much as corn, pound for pound, some of it can be used for growing and fattening pigs that are being fed a good ration including a mineral mixture on good forage.

Grain sorghums. In the regions of the southwestern part of the United States, grain sorghums are grown widely in place of corn, owing to the greater drought-resistant qualities of the sorghums. The group is called grain sorghum to distinguish the the forage sorghums commonly termed cane. In the grain-sorghum belt these grains are more certain than corn and will yield considerably more. These various grain sorghums, kafir, milo, kaoliang, darso, deterita are all common in the great-plains section.

It will be noted in the table of feed composition in the Ap-

pendix that compared with corn the sorghum grains are higher in protein content, about the same in carbohydrate content, lower in fat content, and narrower in nutritive ratio than corn. In spite of this difference the grain sorghums require more tankage than corn. It should also be mentioned that the grain sorghums have a higher fiber content than corn, also they are less palatable than corn.

Feeding the grain sorghums. Although corn is superior for younger pigs, the difference is less marked for pigs weighing over 100 pounds. This indicates a greater lack of such essentials as vitamins, mineral matter, or quality of protein and emphasizes the need for full supplementation. Milo and feterita are worth about 95 per cent as much as corn, while kafir is worth about 5 per cent less. Darso, hegari, and kaoliang are less valuable than the afore-mentioned grain sorghums. These grains are adapted to self-feeding and because of the small hard seeds are improved considerably by grinding. However feeding kafir heads has given good results.

Emmer or speltz. As emmer and speltz are fibrous coated grains they are less valuable than the common basal feeds. They are grown some in the northern section of the corn belt. As was the case with oats, the heavier emmer is to be preferred, as it has a minimum of fiber and a larger percentage of digestible nutrients. Very small quantities are used for hogs and it has been found that grinding and limiting to not more than one-half the ration is necessary to get the best results.

Buckwheat. Buckwheat is seldom used in swine feeding, largely because of the limited amount available and its comparatively low value, due to the fact that the fiber content is over 10 per cent.

Millet. Hog millet is also used some in swine feeding. At the South Dakota Station it was found to be inferior to ground barley in feeding value for swine. Finely-ground hog millet seed at the Colorado Station was equal to corn. Hay millet seed finely ground was worth 95 per cent as much as the hog millet.

Potatoes. In certain parts of the world, potatoes are used extensively as a hog feed. In the United States they are used (other than the culls) only in years of low prices. Low potato

prices prevail when the yield is heavy in the late-potato producing states.

Feeding potatoes to hogs. It is not economical to grow potatoes for hog feeding, but they are low in price or unmerchantable, they may be used as a part of the hog ration. Cooking is necessary to obtain the best results as raw potatoes are not palatable and pigs will consume but small quantities of them. At the South Dakota Station it was found in comparing raw potatoes that 513 pounds of the raw new potatoes equaled 962 pounds of raw old potatoes. Both quantities replaced 100 pounds of corn in the swine ration whereas in an average of three trials 339 pounds of cooked potatoes had the same replacement value. Potatoes apparently lack in the vitamin D, and, because of this lack, feeds high in vitamins are to be included in the ration if there is limited exposure to sunlight. Potatoes should replace more than one-half of the concentrates in the ration.

Dehydrated potatoes. When dried flaked potatoes were fed one part to two parts of corn they were equal to corn. This was with a protein supplement self-fed and with pigs on rape pasture. When fed in quantities over one-third of the gain in the ration, the feed for gain was increased and digestive disturbances occurred.

Molasses. At times molasses is low enough in price to warrant its inclusion in the swine ration in the central part of the United States. The value usually given the feed for swine is less than that of corn, but it may be used as a partial substitute for corn in the ration with apparently good results. If the molasses weighs at least 11.7 pounds per gallon and contains from 50 to 55 per cent of sugar it is worth at least 80 per cent as much as corn. Up to one-fifth of the ration can be made up of molasses. Small amounts are mixed with mineral mixtures and supplemental mixtures to encourage greater consumption by increasing the palatability. However, this practice is of doubtful value. Beet molasses must be fed cautiously because of its purgative action.

Screenings. Occasionally screenings are used in swine ration. A good part of this material is used as an ingredient of molasses feed. Screenings are not very palatable for hogs. They should be ground and mixed with other feeds for hog feeding. Heavy



These pigs are at the self-feeder which is supplied with corn and supplements.

screenings of No. 1 grade are to be preferred because of the greater content of small, imperfect, and broken grain and a smaller amount of chaff. Because of bulkiness, light screenings are not adapted to swine feeding.

Rice polish. Although it does not compare favorably with corn in palatability and it may not have as good effect upon the digestive tract, rice polish is superior to corn on an equal weight basis in a good ration. Arkansas trials indicate the following comparative value: 100 pounds of rice polish equals 125 pounds of corn.

Rice bran is worth from 60 to 90 per cent as much as corn, but is a soft-pork-producing feed and must, therefore, be fed cautiously.

Dried distiller grains. It has been shown that when 9 to 12 per cent of dried distiller grains with solubles are used in a ration of corn, tankage, soybean oil meal, alfalfa meal, and minerals, satisfactory results were obtained. As these products are fibrous the rate and economy gain are less favorable with larger proportions. Best results attend the use of these feeds on pasture.

The wheat by-products. The four wheat products mentioned are the principal ones available for livestock feeding. Approximately 27 per cent of the wheat is made into livestock feed and this is made up of bran 11 per cent, standard middlings (wheat shorts) 11 per cent, and red-dog flour, 5 per cent. The standard middlings consists mostly of fine particles of wheat bran, wheat germ, and very little of the fibrous offal obtained from the "tail of the mill." The material remaining on the screen after the last

break or passing through series of corrugated rollers. Flour middlings are the combination of red-dog flour and standard middlings in the proportions obtained in the usual process of flour milling. Wheat red-dog, or red-dog flour, consists principally of the aleuron layer which is between the bran layer and the starch cells or flour.

Variations in composition. The various wheat by-products are quite variable in composition. This is due to several conditions: (1) Completeness of the milling process. In small mills there is a larger percentage of adhering flour in the middlings and bran. (2) Kind of wheat. Spring wheat, winter, and Durum wheat are the recognized classes, all of which are different in composition. (3) There is a seasonal variation in wheat composition brought about by the variation in environmental factors affecting plant growth. (4) Variation in the manufacturing process. (5) The addition of other materials such as screenings, re-ground oat hulls, corn bran, and similar substances.

The buyer should carefully examine the feed label to determine the composition and ingredients in making selections. When the prefix "pure" is added to a feed name, for example, "pure standard milling," it implies freedom from addition of other materials.

Classification and fiber in wheat by-products. The following standards for fiber content are usually used for materials from milled wheat products:

TABLE 39.

FIBER CONTENT FROM MILLED WHEAT PRODUCTS	CRUDE FIBER NOT MORE THAN
Wheat flour	1.0
White shorts	3.5
Red-dog flour	4.0
Grey shorts	5.5
Flour middlings	6.0
Brown shorts	6.5
White mixed wheat feed (not run)	8.5
Standard middlings	9.5
Wheat bran	10.0



These pigs are at the self-feeder which is supplied with corn and supplements.

screenings of No. 1 grade are to be preferred because of the greater content of small, imperfect, and broken grain and a smaller amount of chaff. Because of bulkiness, light screenings are not adapted to swine feeding.

Rice polish. Although it does not compare favorably with corn in palatability and it may not have as good effect upon the digestive tract, rice polish is superior to corn on an equal weight basis in a good ration. Arkansas trials indicate the following comparative value: 100 pounds of rice polish equals 125 pounds of corn.

Rice bran is worth from 60 to 90 per cent as much as corn, but is a soft-pork-producing feed and must, therefore, be fed cautiously.

Dried distiller grains. It has been shown that when 9 to 12 per cent of dried distiller grains with solubles are used in a ration of corn, tankage, soybean oil meal, alfalfa meal, and minerals, satisfactory results were obtained. As these products are fibrous the rate and economy gain are less favorable with larger proportions. Best results attend the use of these feeds on pasture.

The wheat by-products. The four wheat products mentioned are the principal ones available for livestock feeding. Approximately 27 per cent of the wheat is made into livestock feed and this is made up of bran 11 per cent, standard middlings (wheat shorts) 11 per cent, and red-dog flour, 5 per cent. The standard middlings consists mostly of fine particles of wheat bran, wheat germ, and very little of the fibrous offal obtained from the "tail of the mill." The material remaining on the screen after the last

break or passing through series of corrugated rollers. Flour middlings are the combination of red-dog flour and standard middlings in the proportions obtained in the usual process of flour milling. Wheat red-dog, or red-dog flour, consists principally of the aleuron layer which is between the bran layer and the starch cells or flour.

Variations in composition. The various wheat by-products are quite variable in composition. This is due to several conditions: (1) Completeness of the milling process. In small mills there is a larger percentage of adhering flour in the middlings and bran. (2) Kind of wheat. Spring wheat, winter, and Durum wheat are the recognized classes, all of which are different in composition. (3) There is a seasonal variation in wheat composition brought about by the variation in environmental factors affecting plant growth. (4) Variation in the manufacturing process. (5) The addition of other materials such as screenings, re-ground oat hulls, corn bran, and similar substances.

The buyer should carefully examine the feed label to determine the composition and ingredients in making selections. When the prefix "pure" is added to a feed name, for example, "pure standard milling," it implies freedom from addition of other materials.

Classification and fiber in wheat by-products. The following standards for fiber content are usually used for materials from milled wheat products:

TABLE 39.

FIBER CONTENT FROM MILLED WHEAT PRODUCTS	CRUDE FIBER NOT MORE THAN
Wheat flour	1.0
White shorts	3.5
Red-dog flour	4.0
Grey shorts	5.5
Flour middlings	6.0
Brown shorts	6.5
White mixed wheat feed (not run)	8.5
Standard middlings	9.5
Wheat bran	10.0

Comparative value of wheat middlings. The value of wheat middlings in comparison with other feed is dependent upon how much is used in the ration. If used to supplement corn, not very satisfactory results are obtained especially for young pigs and without pasture. Used as the entire ration, it is inefficient as is corn alone. In comparison with corn as the basis of the ration, wheat middlings are worth about 85 per cent as much as corn on an equal weight basis.

The high feeding value is obtained by using the wheat middling with a corn and tankage combination. Morrison summarized 11 trials in which pigs of an average weight of 63 pounds were fed on dry-lot to make the above comparison, and determined that 100 pounds of wheat middlings so fed replaced 72 pounds of corn and 9 pounds of tankage. With large pigs of 140-pound average, 100 pounds of middlings replaced 108 pounds of corn and 11 pounds of tankage.

Extensive experimental trials on the value of wheat by-products. Minnesota experiments led to the following conclusions concerning the use of wheat by-products for hogs:

1. It is profitable to substitute a wheat by-product for a part of the corn and the tankage fed to growing pigs on alfalfa pasture, providing the mill feed does not cost more per pound than corn.

2. Such a substitution increases daily gains slightly and accordingly reduces the time necessary to bring pigs to market weight.

3. The use of either grade of middlings or of red-dog flour contributes toward improved thrift and health of the pigs.

4. When a choice is made of the three feeds—standard middlings, flour middlings, and red-dog flour—if the differences in prices are normal, flour middlings should be given the preference.

5. It is possible that under conditions differing widely from those prevailing in this trial, different comparative values might be found for the several wheat by-products.

Wheat middlings in mixtures. It has been previously suggested that wheat middlings feed may be used to advantage in

feed mixtures such as pig meals and suckling sow rations. A great number of commercially mixed feeds contain wheat middlings.

Wheat bran. Wheat bran is an excellent feed for some classes of livestock, but for young pigs it is not suitable. About the only place the hog man can use it to advantage would be in a brood sow ration, where its bulk might be helpful.

Rye middlings. Rye is the by-product which results from the manufacture of rye flour. It is inferior to the wheat by-product and, as was the case with the rye grain, should be used sparingly for swine.

Coconut meal or copra. The coconut meal product comes from the coconut-oil extracting industry. It is the residue from the fleshy portion of the coconut. Varying results have attended its use as a swine feed. Feeders should guard against unpalatable meal because of the rancidity which lowers its value.

SUGGESTIONS FOR FURTHER STUDY

1. Determine what common basal feeds are available to swine feeders in your school area.
2. Make a comparison of the relative cost of feeds of the feeds you have listed above.
3. Determine the cost of preparation such as grinding of feeds which you have listed.
4. Survey several farms in your school area and determine which farm grown feeds are fed to swine.

REFERENCES

- MORRISON, F. B. *Feeds and Feeding*. The Morrison Publishing Co., Ithaca, New York
- SMITH, W. W. *Pork Production*. The Macmillan Co., New York

CHAPTER 12

The Protein Supplements, Alfalfa Meal, and Similar Feeds

THE HOME-GROWN feeds commonly makeup the major part of the rations for swine, but most of our natural feeds are low in protein. Further those basal feeds may be low in minerals and vitamins. Consequently the purchased feeds mixed and unmixed are those fairly high in protein content and other nutrients low or deficient in farm-produced feed. Supplements are selected with consideration for their mineral and vitamin contribution as well as protein. The supplementing value of the proteins of the supplement with those of the grains fed is highly important. The list of protein-feeds is quite large. Also there is much experimental evidence on these feeds, used singly and in mixtures. Therefore, there is considerable material to be covered in this chapter. Alfalfa hay and meal and similar feeds are included in this chapter, as not infrequently these feeds make up a part of mixed supplements. That there is need for more information on protein-rich feeds is indicated by the fact that many hog feeders do not supplement home-grown grains. A recent survey in Iowa indicated that many hog feeders were not properly supplementing their home-grown grains being fed to hogs.

The supplements are divided for convenience in the discussion. The divisions of this chapter are plant-protein feeds, animal-protein feeds, alfalfa meal and similar feed, mixed-protein feed, and commercial feed. It should be pointed out that for gen-

eral use, a combination of animal and plant-derived protein feed is very efficient, often excelling either one fed alone. Consequently a separate section is devoted to supplemental mixtures or mixed protein feeds.

Divisions of protein supplements. A very common division of feeds of this nature is on the basis of origin, either from plants or from animals. Animal feeds have usually been preferred, for individually under certain conditions they are of higher value on dry matter basis than those of plant origin. There is not enough of these animal products and by-products to go around. With the usual production of milk by-products, animal tankages, and fish meal, this would be ample for 30 to 40 per cent of the amount needed; 60 to 70 per cent of the protein supplements must come from plant sources. Feeds, like soybean oil meal and similar feeds, are used for this purpose. They are highly efficient if used in the balanced combination.

PLANT-PROTEIN FEEDS

Better results are obtained from the plant sources of protein feeds on pasture than on dry-lot. In general they are of the highest efficiency when fed in proper mixtures. Since the common plant-protein supplement feeds, the oil meals, have about two-thirds the quantity of protein of the animal-protein feeds, like tankage meat meal, their value is roughly about two-thirds of the animal supplements. Because of the lower protein content of the plant-protein feeds more is required to balance a ration.

Soybean oil meal. Soybeans have become one of our most important crops. Nearly three-fourths of the crop is grown for seed. The residue remaining after the extraction of the oil from soybeans is known as soybean oil meal. Soybeans contain about 18 per cent or more oil, varying with the kind. In extracting, about 12 to 17 pounds of the oil is expelled from 100 pounds of the beans. This removes one of the objectionable features of soybeans as the oil in the beans will produce soft pork if fed in excess. This oil is used for many purposes: for human consumption, for soap-making, for making glue, and as a part of paint and varnish. The quantity of soybean oil meal has been increasing with the expansion of soybean growing. Soybean oil meal

rightly prepared is one of the better plant-protein feeds and is economical in price. It does have deficiencies and for best results needs to be properly supplemented. Under certain circumstances soybean oil meal is a satisfactory single supplement. As a single protein supplement with corn and minerals, it is ample for growing and fattening pigs on pasture or for older pigs on dry-lot following a period of pasture feed. This latter case illustrates the carry-over effect of good pasture. Good alfalfa meal is the best substitute for pasture. The most important use is in supplemental mixture. It is now used as a base for many mixed protein feeds.

Methods of manufacture. There are three general methods of extracting oil from soybeans.

1. *Old process.* The ground soybeans are heated and then subjected to hydraulic pressure.

2. *New process.* The oil is extracted from the ground soybeans with a chemical solvent such as benzol.

3. *Expeller method.* The ground soybeans are passed through a machine where, by heating and pressing, the oil is extracted.

Value of different kinds. At the Ohio Station soybean meal of the various kinds, both hand-fed and self-fed, with corn and a mineral mixture was used on dry-lot. When hand-feeding was practiced, the expeller meal with its nutlike taste and odor, the hydraulic meal, the solvent meal, and the raw-tasting expeller soybean meal ranked in the order named, in rapidity of gains, gains from a given amount of feed, and replacement value as compared to tankage. In the self-feeding series the rating was not the same, due to the lameness developing in some of the lots. Robison explained the lameness on the basis of low mineral mixture consumption, and in his opinion the same rating would have prevailed in the self-feeding series if the lameness had not occurred. Soybean oil meal as it now comes to us has been so handled that it is generally of good quality. The right amount of heating is essential in processing, to yield the best product for swine feeding. The soybean oil meals are low in mineral content but respond well when mineral mixtures are a part of the ration.

Soybeans compared with soybean oil meal. The removal of the oil from soybeans increases the percentage of the other nutrients and also improves the palatability; consequently it is of higher value than the soybeans. Most meals are now heated enough to cause the change needed for a good-quality meal. Devoid of the major part of the oil, the soybean product does not produce soft pork. Owing to the fact that soybean meal is affected very definitely in value by the process of production and oil remaining, tests have not always shown a consistent advantage for the meal over the soybeans. If the meal is well prepared it excels the soybeans from which it is derived for growing and fattening pigs.

Soybean oil meal and tankage compared. As would be expected the amount of soybean oil meal consumed by pigs when it is self-fed with corn is greater than if tankage is used. In some instances about equal results will be secured especially on good forage with good quality soybean oil meal and well-grown pigs. This soybean derived product is a satisfactory single supplement for pigs over 75 pounds in weight on good pasture.

Morrison summarized 19 experiments in which comparisons of soybean oil meal and tankage or meat scraps were made on forage for growing and fattening pigs. It was found that 100 pounds of soybean oil meal and three pounds of mineral mixture was equivalent to 43 pounds of tankage or meat scraps and 44 pounds of corn. In 16 trials not on pasture 100 pounds of the soybean oil meal and nine pounds of minerals replaced 71 pounds of tankage and 18 pounds of corn.

When not on pasture pigs fed soybean oil meal with alfalfa meal, corn, and mineral mixture will gain slightly slower than if tankage or similar feeds are used. The consumption of soybean oil meal will also be higher than that of tankage or meat meal. The size of pigs and previous treatment of the pigs will effect the response. Pigs off pasture or that have been well started on an excellent ration will probably do very well on the above ration. With good pasture the rate of gain is about the same with the two supplements but the soybean-oil-meal-fed pigs consume a greater amount of the minerals.

Soybean oil meal. Heating the soybean oil meal improves the protein or biological value since it destroys a factor which inhibits a digestive enzyme. However heating destroys lysine, an essential amino acid. As now processed the temperature is carefully controlled to give the resulting feed the maximum value. It is obvious that the soybeans have a lower protein value than soybean oil meal.

Soybean oil meal in mixed supplement. The place of soybean oil meal in most instances for growing and fattening pigs is in combination. Singly it may do well as a protein supplement to corn and mineral mixture with larger pigs or on pasture. The corn, soybean oil meal, ground alfalfa and minerals ration for pigs is improved by such things as high-quality alfalfa, yeast and wet feeding, dried brewers' yeast, dried distillers solubles, fish-meal, condensed fish solubles, or meat scraps. The feeds listed added individually will commonly cause greater growth, better health, more rapid gains, and less feed is required for gains. Soybean oil meal may not improve the animal protein supplement but will lower the cost of mixture.

Soybeans. Because of the increasing acreage of soybeans, the amount used for swine feeding has been a problem of much interest and investigation. The beans are of high-protein content and the protein is of high value. The most noticeable lack in soybeans is in the mineral matter. The oil content being high may be against the soybean as a swine feed under certain conditions, for this may be responsible for soft pork as well as for reducing the palatability. Sometimes soybeans are the cause of scouring in pigs, which is, no doubt, due to the high oil content. For these reasons it may be advisable to feed limited quantities, and a mineral mixture should always be included with soybeans in the ration. Except for low grade soybeans in most instances it would pay a farmer to sell soybeans for oil extraction and feed soybean oil meal, especially for pigs.

How should the soybeans be fed? Some of the earlier feeding trials indicated that hand-feeding was the best practice. However, in later trials a mixture of soybeans and mineral mixture on forage was found to be the best. Soybeans are fed . . .

ration is justified as whole beans are apparently consumed as readily as the ground beans and have proved as efficient for feeding, in fact the evidence rather favors the whole beans.

Soybeans are improved by cooking, but under farm conditions this improvement would probably not pay for the added expense or preparation. Including raw-ground soybeans as a part of the protein supplements may not give a high value for the beans.

Soybeans and soft carcasses. Because of the oil in the soybeans hogs fed appreciable quantities have a soft fat. If the soybeans in the ration is limited to about 6 per cent of soybeans, apparently satisfactory carcasses will be produced. If 10 per cent of soybeans are fed to pigs it will have a softening effect on the carcass. The length of time that soybeans are fed as well as the daily consumption are factors in the softening effect of this feed upon hog fat. On dry-lot it is usually recommended that the pigs should weigh at least 125 pounds and on pasture 75 pounds before soybean feeding is started. As pigs consume less supplement on pasture a lower starting initial weight is suggested. The softness of the carcass is indicated by the physical appearance of the fat or determined by the iodine number or the refractive index of the fat.

Linseed meal or cake. Linseed meal is the residue of the flaxseed from which linseed oil has been expressed. The oil is used chiefly in the manufacture of paints, and the residue, or cake, is used in livestock feeding. The cake is ground into various sizes for feeding, and it is regarded highly as a protein supplement, especially for cattle and sheep. Very little flaxseed is fed to livestock as such.

Method of manufacture. There are three methods of linseed meal manufacture.

1. The old process extracts the oil from the heated ground flaxseed by hydraulic pressure. Meal of this kind is sometimes designated by the letters "o.p." Practically all of the meal made in this country is of this kind.

2. The expeller method is also used. It is practically the same in value as the hydraulic method meal.

3. The new process uses a solvent to extract the oil. Very little

of such meal is available for feeding. The flaxseed is ground and heated, placed in large percolators, and treated with a chemical solvent, usually naphtha. For swine the oil meal made by this method has been inferior to the hydraulic manufactured meal.

Linseed meal as a single supplement. As was the case with several other plant protein feeds, linseed meal is not balanced in all of the nutritive requirements of pigs, and, as a consequence, should not be used in large quantities in the ration. Under most conditions it is not advisable to use it as a single supplement. Linseed oil meal is not balanced in its amino acid make-up as it is lacking in lysine of the essential ones. As previously noted, it does better on pasture than on dry-lot when used as a single supplement. In some cases when it is self-fed, pigs eat but small amounts of it, indicating a lack of palatability.

When fed singly as a supplement, linseed meal does not rank very high on dry-lot. On good forage and with large pigs it does give good results. Apparently it gives better results with grain other than corn. This is due to the fact that protein contained in this feed is quite similar to that in the usual farm grains. It also lacks in the amount and kind of mineral matter. It is, therefore, evident that mixtures containing linseed meal should be well fortified in protein, vitamins, and mineral matter.

Value as compared with tankage. Pigs fed linseed meal for a supplement make slower gains and have a higher feed for gain requirement than pigs fed tankage or meat meal as a supplement. With tankage three times the cost of corn per pound linseed meal is worth slightly more than half as much as tankage for pigs on dry-lot and a little more on good pasture.

Linseed meal in combinations. Excellent results at the Wisconsin Station with the use of linseed meal with tankage and alfalfa for growing and fattening on dry-lot gave rise to the "trinity 1110 or Wisconsin mixture," which has been popular in swine feeding. This mixture consists of tankage 50 parts, alfalfa meal 25 parts, and linseed meal 25 parts. On good pasture the alfalfa may be omitted and the mixture 60 per cent tankage and 40 per cent linseed meal used. The addition of linseed meal to the corn-and-tankage ration on pasture usually increases the feed

consumption and the rate of gain. In some cases more economical gains have been made. Some results indicate that linseed meal may not improve rations containing barley, skim milk, and alfalfa meal.

Cottonseed meal. Several grades of cottonseed meal are on the market. Most of the hulls of the cotton seeds are separated from the meats, and the cottonseed oil is extracted from these. The residue is the cottonseed cake. This is ground or broken into various sizes to suit the trade. When finely ground, it is called meal. The meal contains 43 or more per cent of crude protein and in addition about 7.0 per cent crude fat, 10 per cent crude fiber, 27 per cent nitrogen-free extract, 7 per cent moisture, and 6 per cent ash. One ton of cottonseed produces approximately 950 to 960 pounds of cake and meal and from 525 to 600 pounds of hulls. As cottonseed meal contains a toxic material, gossypol, it must be fed carefully to pigs. Of the two forms, free gossypol and d-gossypol, the former is far more toxic. This toxicity is overcome by proper supplementation, and limitation of the amount fed or heat treatment of the meal. Vitamin-A deficiencies may cause trouble on some cottonseed meal rations, but it still has a toxic principle to which pigs are apparently quite susceptible. Only cottonseed meal of high quality should be used for swine feed. Cottonseed meal contains proteins slightly less valuable than linseed oil meal for growing pigs, as pigs retain a larger percentage of the absorbed protein of the latter. However cottonseed meal contains 7 to 8 per cent more crude protein than linseed meal, so less is required to balance farm grown grain. When used in supplemental mixtures there appears to be practically no great difference in the value of the two. Linseed meal appears slightly better for young pigs on drylot when at a 25 per cent level in mixed supplements.

Variation in cottonseed meal. In addition to the variation in grade there is also a difference in value due to the presence or absence of the hull. Usually the lower the content of protein the higher the fiber content or percentage of hulls. Those cottonseed oil-extract products in which some of the hulls are included are termed "cottonseed feed." These are not profitable to use for hogs because of the fiber. Detoxicated or inactivated

gossypol meal can be procured, and, if large amounts are to be used in the ration, this form may be preferred. Heating and perhaps the addition of iron salts decreases the toxicity. The deficiencies of cottonseed meal or toxicity cannot be entirely overcome by feeding with corn, alfalfa meal, or cod-liver oil. The raw cottonseed should not be used as it is not satisfactory, probably because of the poisonous material and the high fat content. The toxic quality of the cottonseed is dependent upon the variety of the seed, and upon the climate and soil on which the plant is grown.

Tankage and cottonseed meal compared. A comparison is seldom made between tankage and cottonseed meal singly. Although cottonseed meal is a cheap source of protein in most years, its toxicity has restricted its use as a supplement for swine. Pigs do well on it for a time, using up to one-sixth of the ration, but the ill effects soon make their appearance. To obtain the best results from the use of this feed it must be fed sparingly. Not over 0.35 pounds daily per 100 pounds live weight should be fed to growing and fattening pigs. Some trials have shown cottonseed meal about as valuable as tankage under certain conditions.

Death loss on cottonseed meal. At the Ohio Station 11 dry-lot experiments have been conducted in which hydraulic or standard cottonseed meal was used. The ration was yellow corn, cottonseed meal, ground alfalfa, and minerals. Of the total of 124 pigs on the ration 66 died. Only in one trial was there no death loss.

The harmful effect was not overcome by supplying vitamin A. Moistening and autoclaving (cooking with steam) reduced the death loss. Iron sulfate treatment of the meal overcame the toxicity. Tankage fed also reduced the death loss.

The cottonseed meal proved to be 92.5 per cent as valuable as linseed meal along with corn tankage ground alfalfa and minerals. However iron-treated cottonseed meal was worth as much as linseed meal in the same combination.

How to feed cottonseed meal in safety. Under usual conditions up to 9 per cent of the ration, and perhaps up to 15 per cent may be fed without producing ill effects. In practice the

limit of feeding is 50 per cent of a protein supplemental mixture for pigs. Feeding on pasture is a safe precaution as this retards or prevents the injurious effect. In the absence of pasture, some legume roughage, like alfalfa meal, should be included in the ration. It is also advisable to allow a mineral mixture, and it is not advisable to self-feed the cottonseed meal, free-choice style, for very long periods, although no ill effects resulted in one 55-day trial. Cottonseed meal has shown up very well in supplemental mixtures like tankage or meat scraps 50 parts and cottonseed meal 50 parts.

Other common supplemental mixtures including cottonseed meal follow:

FOR USE ON PASTURE	
Tankage or meat scraps	50 parts
Linseed oil meal	25 parts
Cottonseed meal	25 parts
FOR USE ON DRY-LOT	
Tankage or meat scraps	40 parts
Cottonseed meal	20 parts
Linseed oil meal	20 parts
Alfalfa meal	20 parts

These mixtures are not only superior to straight tankage in gains and feed for unit of gain, but they also are usually cheaper pound for pound than tankage or meat scraps. Most supplements for swine are improved by the addition of some cottonseed meal.

Peanuts. Even though peanuts contain from 30 to 40 per cent by weight of oil, the protein content ranges from 25 to 30 per cent. It is, therefore, evident that peanuts may be used as a protein supplement. The oil contained is an objectionable feature and will cause soft pork like the oil from soybeans. Hogs are used to harvest the crop and to pick up the peanuts remaining in the field upon harvesting. In peanut-growing areas pigs are sold subject to examination of the carcass for hardness and discounted according to the degree of softness.

Nutritionally peanuts rank high, and young pigs will do well

on rations consisting mainly of peanuts plus alfalfa and a mineral supplement on dry-lot. A peanut ration used up to 85 pounds of live weight will not produce softness of the carcass fat. When fed therefore, this feed is best used for young pigs and in rations for breeding stock considering the inferiority of the hog carcasses softened by peanut feeding.

Peanut oil meal is prepared by extracting the oil from the dehulled peanut. The first and second grades of peanut meats are used for human consumption. The third grade is used for peanut oil and meal. It is made up of small, whole nuts, shriveled and immature meats, and all fragments of meats broken by the hulling and grading machines. Ten per cent ground hulls are added to standardize the protein content of the meal. The meats are ground by being passed through rollers, then cooked with the 10 per cent hulls, then put in molds and pressed. The meal is made from the resulting cake by grinding. Peanut meal contains 43 to 45 per cent protein, or sometimes more, 6 per cent fat, and 9 to 17 per cent crude fiber.

Little difference is found in the rate of grain or feed requirement per unit of gain on rations composed of seven parts corn and one part peanut meal, two parts corn and one part peanut meal, or equal parts of the two. When oil is not removed fairly completely the value for feeding is lessened. Over 20 per cent peanut meal in the ration with corn usually may have a tendency to produce soft pork, depending upon the percentage of oil.

Owing to its high palatability, good quality of proteins, and high protein content, this feed ranks high as a supplemental feed. In some trials it has outranked tankage when used as a single supplement.

Peanut meal feed. Peanut meal feed, which includes the hull as well as the meal and has the oil removed, is just fair as a single supplement. Compared to a base ration of corn with soybean meal it was inferior, as the gains were slower and feed requirement higher. The hulls are a serious objection in hog feed, and, if this feed is to be used, it should be used in small quantities in mixtures. The shell percentage is not constant, and in some cases shell-containing peanut meal has given good results when compared with the shell-free peanut meal.

In trials, pigs which received the peanut meal with hull, gained 1.16 pounds per head daily and required 499.6 total pounds of feed for 100 pounds gain. The other group gained 1.28 pounds per head daily and required 406.8 total pounds to make the 100 pounds gain.

By-products from corn. When corn is processed, three high-protein by-products are produced: corn-gluten meal, corn-gluten feed, and corn-germ meal. These are used in livestock feeding as protein supplements. No. 3 shelled corn weighing 7,200 pounds produces 2,000 pounds total by-product. The approximate yield is 15.5 per cent of corn-gluten meal, 9.2 per cent of corn-gluten feed, and 3 per cent of corn-germ meal.

Gluten meal. Gluten meal feed contains most of the gluten from the corn, and it is a product resulting in the processing of corn. It is the portion remaining after the removal of most of the starch and glucose from corn. It may or may not contain the corn solubles.

Difference between gluten meal and feed. Gluten meal contains from 27 to 40 per cent protein, and when it is mixed with the corn bran the mixture is called gluten feed. It contains 17 to 25 per cent protein and may contain some of the corn oil meal.

These feeds do not rank high as supplements to corn for hogs. They are better feeds for cattle and sheep than for growing and fattening pigs.

Gluten feed, self-fed as a lone supplement to corn on rape pasture for young growing pigs at the Iowa Station, reduced the gains, increased the feed requirement, and lowered the margin per pig. Gluten meal and feed when used should be in combinations for swine. However, in some cases where it was used in addition to corn and tankage, it did not appreciably affect the rate of gain, the economy of gain, or margin per pig.

Corn-germ meal or corn-cake meal. Corn-germ meal is also called "hominy hearts" and "corn-oil meal." Upon extraction of the oil from the germ this material remains. There are two types of this meal, one in which the germs are separated by a mechanical process in the manufacturing of hominy, and the other in which the germs are separated partially by soaking in dilute acid

in the making of starch. In fact, they are often termed "hominy corn-germ meal," and "starch corn-germ meal."

Corn-germ meal as a supplement. Owing to the fact that the proteins contained are the same in amino acids or protein-building stones, corn-germ feed is not satisfactory as a sole protein supplement, but is much better than gluten feed or meal. In fact, for this purpose it is inferior to linseed meal. In the Trinity mixtur meal.

is of greater value than the other, due to its greater palatability. Favorable results occasionally obtained are no doubt from the hominy corn-germ meal. Morrison's summarization indicates that when added to the corn and tankage ration on dry-lot 100 pounds saves 46 pounds of tankage and 17 pounds of corn; on pasture 42 pounds of tankage and 45 pounds of corn was saved. Corn-germ meal is best used as a partial substitute for corn and the protein-rich feed.

Buckwheat middlings. This is one of the by-products of the manufacture of buckwheat flour. For best results in swine feeding it should not contain the woody, fibrous hulls of the buckwheat seed, but is made of the part of the kernel just under the hull, which is separated in the milling process.

Excellent results attended its use as a single supplement in the trials at the Ohio Station on forage.

Beans. At the Michigan Station several tests have been conducted on the use of cull beans for feeding hogs. It is usually advised that the beans be cooked for feeding and that they be fed with equal parts of corn. Beans, as the entire ration or making up a large part of it, produce soft pork. The Michigan trials give information on the question of using cull beans for hogs on dry-lot, and the investigators made the following summary:

1. Ground corn and tankage produced much larger daily gains and required considerably less feed for 100 pounds of gain than did any other feed combinations used. The high cost of corn and tankage, however, made the gains produced by these feeds the most expensive.

2. The addition of tankage to cull navy beans and ground

corn increased the average daily gains 0.252 pounds, lowered the feed required for 100 pounds of gain 15 per cent, and reduced the cost of gains 0.7 per cent.

Although cull navy beans have a high protein content, this protein is relatively low in feeding value. The addition of tankage, which is an animal protein, brought about a big improvement in the ration. This was shown by increased gains and lower cost of production in both cases where this supplement was used.

Dried distiller solubles. Dried distiller solubles is rich in the B-complex vitamins. It would be helpful in rations either for pigs or sows that lack these essential vitamins. Under some conditions the solubles are mixed with dried distillers grains.

Field peas. In sections where they are grown extensively field peas may be used in swine rations economically under certain conditions. The pigs are usually turned into the field of mature peas and allowed to hog them down. When peas are relatively cheap or if cull peas are available the hog can serve as a utilizer for the same.

Cull peas compare very favorably with meat meal and soybean oil meal as a protein concentrate for growing and fattening pigs fed in dry-lot. The summary on the use of cull peas for growing and fattening swine follows:

1. In each of three years' trials, rations of wheat and barley supplemented wholly or in part with cull peas and fed to growing fattening pigs on sudangrass pastures produced as rapid and efficient gains as rations supplemented with meat meal or soybean oil meal.

2. In two years of dry-lot trials with growing-fattening pigs, rations supplemented with cull peas produced more rapid and considerably more efficient gains than did rations supplemented with meat meal. Cull peas proved to be superior to soybean oil meal in rations containing 5 per cent and in those containing 15 per cent alfalfa in the one year's trials in which they were compared.

Cowpeas have been tried and found of value in the swine ration with corn. It was found that cowpeas supplement the ration

of corn but when fed individually do not give good results. Equal parts of corn and cowpeas have given favorable returns, however. Based on the composition, the cowpeas should be fed in about the same proportion as velvet beans; that is, about one part of cowpeas to four parts of corn.

Velvet beans without preparation have not been found satisfactory for hog feeding in many cases. When they constitute a very large percentage of the ration, as will be noted in the following paragraphs, preparation such as dehulling and grinding does not materially influence their value.

Velvet bean meal does not rank high as a supplement for swine owing to its lack of palatability. When used in quantities ample to balance the ration and mixed with the other feed, pigs consume only enough to maintain their weight.

Velvet bean meal, including hulls, has been found to be inferior to tankage or soybean meal used with a base ration of corn. Its lack of palatability and its fibrous character when hulls are included account for its poor showing.

Yeast. As previously indicated in Chapter 9, page 214, yeast is rich in protein and some vitamins. When judiciously used it may improve a dry-lot ration.

Urea. In spite of the fact that urea can be used successfully to replace a part of the protein in rations for sheep and cattle, it should not be used for swine. The ruminants make use of it through bacterial fermentation in the rumen or paunch.

Sunflower seed. Equal parts of corn and sunflower seed have given fairly good results in swine feeding.

Mustard seed oil meal. Mustard seed oil meal is satisfactory when mixed with tankage and other protein supplements and self-fed free choice.

THE ANIMAL-PROTEIN FEEDS

Animal-protein feeds occupy a prominent place in supplementing swine rations. Reduction in the production of fish meal and diversion of more of the milk products for human consumption, makes less of these materials for swine rations. The animal-protein feeds are very high in supplementing value, however, the amount in ration can be reduced from complete supplement-

ation and soybean oil meal incorporated for a partial substitute. In some cases plant-derived protein feeds can be used successfully for the supplement.

Tankage. Tankage has derived its name from the method of manufacture. It is made up of a group of different meat residues. Clemen, in *By-Products of the Packing Industry*,¹ gives the following as typical of meat residues:

TABLE 40. DIFFERENT MEAT RESIDUES MAKING UP TANKAGE

MEAT RESIDUES	PROTEIN, PER CENT	FAT, PER CENT	BONE PHOS- PHATE, PER CENT
Meat meal (tankage).....	50-60	5-10	21.85
Meat scrap (cracklings).....	50-60	5-10	21.85
Meat-and-bone meal or scrap.....	40-50	5-10	21.85
Blood meal.....	80-85	....	...
Poultry bone in various sizes.....	20-25	3	40-50
Pure raw-bone meal.....	20-25	3	40-50
Special feeding bone meal.....	5-10	.	65

Meat meal, meat scrap, tankage, and digester tankage are made from the same materials: bone, meat, dried blood, and concentrate tank water (stick). They vary some in percentage of composition but do not include hoofs, horns, manure, and stomach contents and do not contain more than 10 per cent of phosphoric acid. In the packing process the tankage yield is approximately as follows: cattle, 15 pounds; calves, 2 pounds; sheep and lambs, 2 pounds; swine, 5 pounds. The fats and oils are partially extracted in the processing.

Tankage manufacturers. There are several groups of tankage manufacturers:

1. *Packing-house tankage* is made from meat and bone residues which are obtained in the processing.

2. *Rendering-plant tankage or reduction tankage* is made from dead animals.

3. *Compound tankage* is made by manufacturers who buy the ingredients from small packing plants and rendering plants.

¹ By permission of University of Chicago Press.

4. *Garbage tankage* is the reduction material from garbage.

5. *Green or wet tankage* is tankage made in small rendering plants unequipped with driers. It contains a large amount of water, cannot be stored, and is used in the immediate vicinity of the plant where it is produced.

Methods of manufacture. Two common methods of making tankage are in use.

1. *Wet-rendering method.* This is the old pressure-tank method in which live steam comes in contact with the material digested.

2. *Dry-rendering method.* Rendered in a steam-jacketed tank. The live steam does not come in contact with the material. No water or steam is ejected into the material during the process of manufacturing. The dry-rendered product is lighter in color than the wet-rendered tankage. It also has a less disagreeable odor.

The dry method is replacing the wet method of rendering animal residues for feed purposes.

Definition of various packing-house by-products. The common packing-house by-product feeds consumed by swine are defined as follows by the Association of American Feed control officials.

Meat meal or meat scrap is the finely ground, dry-rendered residue from animal tissues exclusive of hair, hoof, horn, blood, manure, and stomach contents, except in such traces as might occur unavoidably in good factory practice. When these products contain more than 4.4 per cent of phosphorus (P), they shall be designated either "Meat and Bone Meal" or "Meat and Bone Scrap." If the product bears a name descriptive of its kind, composition, or origin it must correspond thereto. It must be designated and sold according to its protein content.

Digester tankage, meat meal tankage, or feeding tankage is the finely ground, dried residue from animal tissues exclusive of hair, hoof, horn, manure, and stomach contents, except in such traces as might occur unavoidably in good factory practice.

especially prepared for feeding purposes by tanking under live steam, or by dry-rendering, or a mixture of the products. When these products contain more than 4.4 per cent of phosphorus (P), they must be designated "Digester Tankage with Bone," "Meat and Bone Meal Digester Tankage," "Meat and Bone Meal Tankage," or "Feeding Tankage with Bone." If the product bears a name descriptive of its kind, composition, or origin it must correspond thereto. It must be designated and sold according to its protein content.

Tankages may be produced by either the dry- or wet-rendered process, further they may have additions of "stick" or blood. Meat scraps are the dry-rendered products and have no "stick" or blood added. "Stick" is the evaporated tank water.

Value of different kinds of tankage. It has been generally believed that the value of tankage is in proportion to its protein content. Therefore, if 60 per cent protein tankage was worth \$120 per ton, 50 per cent protein tankage would be worth \$100 per ton. This may be true under certain conditions, but recent experimental work indicates that the protein content may not be expressive of the difference.

The tankage tested at Purdue University by feeding with shelled corn to growing and fattening pigs on legume pasture (alfalfa or clover) were of practically the same feeding value regardless of the difference in protein content, method of manufacture, or source of meat and bone.

Other values of tankage. Amount of protein is only one measure of the value of a supplement like tankage. The indispensable amino acids tryptophane and lysine are supplied by tankage and meat scraps. These essentials are deficient in corn. Also the meat products contain the animal-protein factor and other B-complex vitamins.

Use of tankage with corn on pasture. There is less need for a feed like tankage with corn when good pasture is available, but under most conditions the supplement pays for itself in more rapid and economical gains. The following data from the Iowa Station gives results with pigs weighing from 50 to 225 pounds.

On rape pasture 29 pounds of tankage saved 268 pounds of

TABLE 41. CORN ALONE VERSUS CORN SUPPLEMENTED WITH TANKAGE ON PASTURE

LOT NUMBER AND FEED	NUMBER DAYS REQUIRED TO REACH 225 POUNDS	AVERAGE DAILY GAIN PER PIG, POUNDS	AVERAGE DAILY FEED EATEN PER PIG, TOTAL POUNDS	FEED REQUIRED FOR 100 POUNDS GAIN	
				Basal and other feeds	Total
	On rape pasture				
I. Corn alone .	277	.64	4.0	623 corn	623
II. Corn..... Tankage...	125	1.42	5.5	355 corn 29 tankage	384
	On blue-grass pasture				
III. Corn alone..	243	.73	4.2	572 corn	572
IV. Corn..... Tankage ..	126	1.41	5.4	349 corn 31 tankage	380

corn, and on bluegrass pasture 31 pounds of tankage saved 223 pounds of corn.

Feed saved by tankage. Comparisons of corn alone versus corn and tankage indicate a high value for this protein supplement especially with young pigs. Morrison summarized seven trials with pigs of an initial weight of about 69 pounds and found that 100 pounds of tankage fed saved 607 pounds of corn. Twenty-two trials with pigs of 136 pounds average initial weight, showed a saving of 538 pounds of corn for each 100 pounds of tankage fed.

Tankage or meat scraps compared to other supplements. Tankage has a very high rank as a supplemental feed and is worth more per pound than most of the feeds of its kind. Corn and tankage is an excellent ration under some conditions for the reason that the latter supplies to the shortcomings of the former. In fact, as a protein supplement to corn in a good ration, tankage meat scraps is one of the best. Milk is usually a little better, but it requires more pounds of dry matter from milk than tankage. A pound of tankage or meat scraps is worth more than one pound of dried milk. Because of its low carbohydrates (espe-

cially fiber) content, high protein content, high mineral content, the quality of protein and mineral matter, and its high palatability, tankage holds a prominent position as a balancer for common home-grown grains in swine rations.

Tankage or meat scraps in combination. A good supplemental mixture has in most cases a large percentage of tankage or meat scraps. While tankage in itself is good fed with corn, especially on pasture, feeders should realize that in order to obtain its greatest value, combinations with other high proteins, vitamins, and mineral feeds are necessary for best results.

Tankage and similar feeds as a source of disease. As this material is sterilized in the making, there is no danger of disease dissemination from this product provided that contamination does not take place after it has been made. Rendering plants making feeding tankage are usually inspected carefully by state inspectors in order to maintain the best possible sanitary conditions. Although the animals from which the feed is made may have been affected with diseases, the sterilization process destroys the disease organisms.

Blood meal. Although higher in protein content, it is less valuable, pound for pound, than good tankage in the swine ration. It is usually too high in price to be economical for the swine feeder to use.

Garbage tankage. The reduction of garbage by the tanking process is rather new, and, consequently, we are uncertain as to its value under varying conditions. Apparently, the value is influenced by the method of manufacture. Garbage reduced by the McCullough process has shown up fairly well in comparison with animal tankages but produced much slower gain. Other garbage tankage tried at the Iowa Station did not give encouraging results except with well-grown shoates and on good pasture.

Fish meal. The value of fish meal is dependent upon the material used and the method of preparation.

Preparing. The same two methods used with meat products, mainly the wet and dry, are used in the preparation of feeding fish meal. Some green fish meal is used in the immediate vicinity of the place of manufacture. This is cooked fish meal but the

water has not been removed. The yield is higher in the dry process, four and one-half tons producing one ton of fish meal, while in the other process six tons produce one ton of fish meal. The dry or vacuum-dried method usually produces the best quality of meal for feeding. This method is replacing other methods of preparation because of the high value of the product due to lower temperatures used.

Place of manufacture. As this material is made along the seaboard it must be shipped rather long distances to many swine-feeding farmers. There has been a rapid increase in the amount made, and consequently more is available for feeding. Hog feeders nearest the sources have the advantage in price. Fish meal can be used most profitably as a part of the supplemental feed rather than the sole supplement. Fish meals are made in many countries. Leading among these are Norway, France, Canada, Japan, India, and England.

Compared with other supplements. Morrison summarized 18 experiments in which fish meal was compared with tankage, bringing out a noticeable difference in value.

TABLE 42. FISH MEAL COMPARED WITH TANKAGE

RATION	DAILY GAIN	FEED FOR 100 POUNDS GAIN	
		Corn	Supplement
Fish meal and corn.....	1.68	349	35
Tankage and corn	1.46	381	37

On the average, fish meal proved superior to tankage from the gain and feed efficiency standpoint; 100 pounds of fish meal saved 106 pounds of tankage and 91 pounds of corn. Fish meal was responsible for a daily gain increase of 0.22 pounds. Fish meal apparently is of greater value to young pigs than tankage.

Fish meal in combinations. With the establishment of the high value of fish meal in swine rations there has been an increased usage of this material in supplementary blends or rations. The addition of fish meal to supplemental mixtures has generally proved economical.

Condensed fish solubles. This is also known as condensed press water. It results from the hydraulic process of removing oil from fish or fish trimmings. It is rich in water-soluble proteins and vitamins. Commonly it is disposed of as an ingredient of commercially mixed feed, as it is rather disagreeable to handle without the right equipment. For dry-lot feeding it usually takes about one half as much fish solubles as fish meal for supplementation.

Skim milk and buttermilk. In composition these two milk by-products are much the same. They are excellent protein supplements for swine. With the increased use of milk solids in human food less of these are available for swine feeding. Buttermilk to which no wash water has been added has slightly less dry matter, and digestible crude protein but slightly more total digestible nutrients than separated skim milk. The difference is very slight but on carefully controlled experimental trials, skim milk is slightly superior to buttermilk.

Factors influencing the value of skim milk. The value of skim milk or buttermilk is dependent largely on:

1. The level of feeding. The more milk fed the less its value comparatively.
2. Conditions under which it is fed. As would be expected these products are worth more for dry-lot feeding than when used on pasture.
3. The age and weight of the pigs fed. Milk has its greatest value when fed to young pigs.

Age of pigs to feed milk. The dairy by-products must be regarded as one of the best supplemental feeds for all classes of swine. Young pigs should come first in receiving the supply of milk by-products. That either skim milk or buttermilk is highly efficacious in the suckling pig ration has been shown. Next in choice for the use of these products should come the pigs at weaning time. Suckling sows also use milk in the ration to good advantage. After these have been taken care of, the remainder may be used for the growing and fattening pigs.

Amount of feed. It is advisable to give this feed to all groups of pigs if the supply is insufficient to allow each group enough to

balance the ration. It is seldom advisable to practice heavy feeding of either skim milk or buttermilk, for it serves best as a supplemental feed and it contains such a high percentage of water that pigs consuming large quantities will be required to take more water than their normal allowance or actual need. Although pigs will consume the milk freely, it probably would be economical in most cases to limit the consumption to less than ten pounds daily on dry-lot and to five pounds daily on pasture. This limitation is based on usual average conditions. When the amount of milk is increased to the point of furnishing an excess of protein, the efficiency is lessened. The lower the ratio of milk by-products to grain or basal concentrate, the greater the returns per unit consumed. The optimum proportion of skim milk or buttermilk to grain varies with the size and age of the pigs, whether or not pasture is included, and other factors. About 2.0 pounds of the milk to one pound of grain fed is the rule to follow in making up proportions.

Skim milk as the entire ration. No matter how cheap the skim milk or buttermilk can be purchased, it is usually profitable to feed with other feed rather than use it as the entire ration. Skim milk is lacking in vitamin content and certain mineral elements and is too watery to make up a large part of the ration or to be fed as the sole feed.

Sweet or sour milk. Changing from sweet to sour milk is inadvisable, as this causes digestive disturbance. Sanitary conditions being good, sour milk is as good as sweet milk. Usually the latter is the choice of hog feeders when available.

Feeds replaced by skim milk or buttermilk. It must be remembered that about 5 per cent of the milk product is milk sugar or lactose, a carbohydrate which would take the place of carbonaceous feed in the ration. These products, then, not only replace tankage but also cut down the consumption of the basal feed, such as corn.

The larger percentage of protein in tankage is responsible for its greater value for supplementing on the dry-matter basis. The high value of the protein content of the milk products is due to the quality and availability of this material. Trials summarized by Morrison on skim milk verses tankage on 138 pigs averaging

75 pounds of weight at the start indicated a value, for 100 pounds of skim milk, of 10.86 pounds of corn and 7.29 pounds of tankage.

Tankage and buttermilk compared. Creamery buttermilk or its practical equivalent, skim milk, excels tankage for most classes of swine. Two-year trials at the Minnesota Station led to the following conclusions:

The feeding of dried buttermilk, semisolid buttermilk, or creamery buttermilk as a protein supplement in rations for growing pigs increased slightly the daily gains, as contrasted with tankage.

The saving in time necessary to increase the weight of a growing pig by 100 pounds was six days when either kind of buttermilk was fed instead of tankage.

Not considering the cost, the use of any one of the four protein supplemental feeds (tankage, dried buttermilk, semisolid buttermilk, and creamery buttermilk) resulted in satisfactory rations.

Creamery buttermilk or tankage produces the most economical gains, with dried buttermilk third and semisolid buttermilk fourth.

For growing pigs on good pasture the commercial buttermilk feeds are not as cheap sources of protein as either tankage or creamery buttermilk.

Diseases from dairy by-products. Pasteurized products, if the milk is from uncertain origin, are desirable as there is a possibility of disease being spread through this medium. Milk products from accredited and abortion-free herds are entirely safe for swine feeding. The dried and semisolid products are sterile when made and are free from disease organisms.

Skim milk and whey for internal parasites. Liberal quantities of skim milk and whey have been found to be effective in protecting swine from internal parasites. Although exposed to internal parasites of the intestinal tract, pigs fed the milk products escaped acquiring large numbers of stomach worms, ascarids, nodular worms, and whipworms. Other parasites outside of the digestive tract were not reduced. Pigs on milk

acquired the roundworms, and they migrated to the liver and lungs but they were swept out by the purgative action.

Since the parasites are not wholly removed by the milk, hog raisers should not dispense with the usual management measures for ascarids or roundworm control.

Condensed buttermilk. Evaporated or condensed buttermilk may be a valuable addition to the ration for growing and fattening pigs. Its value is based on its dry-matter content which is variable in different samples. The dry-matter content should not be less than 27 per cent. If it contains about 20 per cent of dry matter it is worth 3.2 times as much as ordinary buttermilk, as the value of the dry matter for feeding has not been lessened by the reduction process. It is usually considered best to feed it in about the same consistency as creamery buttermilk, and one should not be misled by statements regarding the mixing proportion. If it is mixed with a large proportion of water, the pigs consume more water than necessary and the value of the dry matter is not enhanced by its addition. The semisolid material may be stored, which is a point in its favor, and often it is more convenient to feed than the ordinary product. A South Dakota swine feeding experiment indicated that one pound of semisolid buttermilk was equivalent to 3.2 pounds of creamery buttermilk. It will take about three pounds of the semisolid product to equal one pound of good tankage in the swine ration.

Dried buttermilk. Dried buttermilk contains about 90 per cent of dry matter, whereas ordinary creamery buttermilk or skim milk contains about 10 per cent dry matter. Ten pounds with 90 pounds of water would, therefore, be about the same as the by-product direct from the creamery. At the Iowa Station in trying out various proportions of dried buttermilk and tankage with a ration of corn and block salt self-fed, it was shown that the addition of buttermilk powder increased the gains and decreased the feed requirement. One hundred pounds of the buttermilk powder was approximately equal to 75 or 90 pounds of tankage. At usual prices it may be too high in price to be used in feeding market hogs as the entire supplement. In an Ohio trial with pigs of an initial weight of about 37 pounds, dried milk was added in three levels to a yellow corn, tankage, linseed

meal, ground alfalfa, and minerals ration. The lowest level which was equivalent to but 0.4 pounds of liquid milk per day per pig slightly greater gains were made with a slightly lower feed requirement. Also the milk addition improved the ration.

Whey. This by-product of the cheese factory is rather high in water content, but the dry matter is of high supplemental value for swine. The quality of protein of whey is very high. Casein makes up about three-fourths of the milk proteins and it is slightly inferior to the entire proteins of milk in supplementing value. Milk albumin is the principal protein of whey and it is slightly higher than casein in biological value. In addition to the albumin whey also contains the milk sugar and most of the milk minerals. Whey can be used as entire protein supplement for older pigs or with pigs on a basal feed of corn, although linseed oil meal, or wheat middlings may be economical additions. When fed over the level of 8 per cent of the ration, scours and reduced appetite may result. Experimental trials indicate that skimmed whey is worth about half as much as skim milk or buttermilk.

Condensed and dried whey. The condensation products of whey, the semisolid, and dried are available for swine feeding. Commonly these are permitted to process by fermentation which increases the vitamin content, particularly riboflavin and pyridoxine.

At the Illinois Station the dry-lot ration, ground yellow corn 66.5 per cent, meat and bone scraps 5 per cent, soybean meal 27.5 per cent, limestone 0.5 per cent, iodized salt 0.5 per cent, plus irradiated yeast and manganese salt, was improved by fortified dry whey by-product.

Cheese parings or meal. This is a by-product from the manufacture of processed cheese and consists of the trimmings. Wisconsin trials indicate that this material is an excellent supplement and superior to tankage.

Infertile eggs. Incubated infertile eggs, the by-product of hatcheries, are quite commonly fed to hogs. The evidence indicates that pigs will make satisfactory gains on a ration of incubated eggs, yellow corn, and salt. Raw incubated eggs are apparently used as efficiently as the cooked incubated eggs. In

one trial 100 pounds of eggs, about 67 dozen, had a replacement value of 14.4 pounds of ground yellow corn, 12.0 pounds of meat scraps, 4.6 pounds of linseed meal, and 4.6 pounds of alfalfa meal, or a total of 35.6 pounds of feed. In some animals the egg white is poorly digested, apparently such is not the case with swine when incubated eggs are fed.

Alfalfa meals and similar feeds. These materials, particularly the alfalfa meal has greatly increased in popularity in swine rations. The high quality meals are particularly valuable as vitamin carriers. Since yellow corn is not too reliable a source of carotene or provitamin A, hog raisers use alfalfa hay and meal which is a rich source, if properly handled. The manufacturing feed industry uses over a million tons of alfalfa meal per year, about 3 per cent of all feed sold is of this meal.

Definition of alfalfa products used for swine. In order that a clear understanding is acquired of the alfalfa products commonly fed swine the following definitions are in order. These definitions are by the Association of America Feed Control Officials.

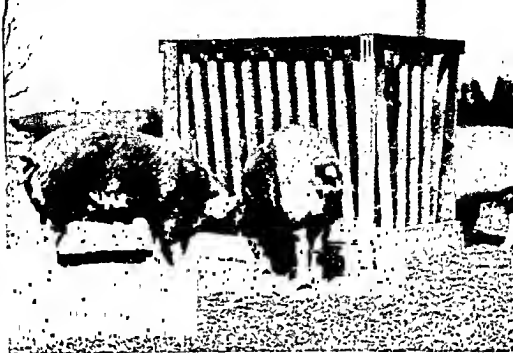
Chopped alfalfa or cut alfalfa is chopped or cut alfalfa hay which is reasonably free of other crop plants, weeds, and mold, and is not ground finely enough to become meal.

Alfalfa meal is the product obtained by grinding alfalfa hay which is reasonably free of other crop plants, weeds, and mold. It must contain not more than 33 per cent of crude fiber.

Alfalfa leaf meal is the ground product consisting chiefly of leafy material separated from alfalfa hay or meal. It must be reasonably free from other crop plants and weeds and must not contain more than 18 per cent crude fiber.

Alfalfa stem meal is the ground product remaining after the separation of the leafy material from alfalfa hay or meal. It must be reasonably free from other crop plants and weeds.

Dehydrated may precede the name of the alfalfa product, provided that the freshly-cut alfalfa having a moisture content of not less than 50 per cent has been artificially dried at a temperature of at least 100° C. or 212° F., that the drying process covers a period of not more than 40 minutes, and that there is no admixture of sun-cured alfalfa.



Here are three brood sows on alfalfa hay. Under most dry-lot conditions alfalfa will improve the brood-sow ration.

Alfalfa hay and meal quality. Only the best quality of alfalfa hay or meal is to be used in rations for growing and fattening pigs. All feeds vary in composition but there are very few more variable than the dried alfalfa plant. It is known that the variety of the alfalfa, the fertility of the soil on which it is grown, and the stage of maturity when cut effect the composition. Much depends on the composition of the meal upon the means of treatment. The alfalfa can be cured as hay or dehydrated. Also the curing can be in the field or in the mow. Then the material is reduced in fineness by grinding. Of the carotene in alfalfa the per cent loss would be about as shown in the table on page 288. The various methods of treatment are also given.

The above figures are fairly representative. They do indicate the great loss of carotene which occurs in curing and poor treatment.

Alfalfa meal composition. Lyman Peck in the feedstuffs analysis table (1918) gives the composition listed on page 288 for various alfalfa feedstuffs. The composition given is to assist feed manufacturers in formulating feeds. A safety margin is used to meet required guarantees. Consequently the protein and

SWINE MANAGEMENT

TABLE 43. PERCENTAGE LOSS OF CAROTENE IN ALFALFA DUE TO VARIOUS TREATMENTS

TREATMENT	PER CENT OF CAROTENE RETAINED	
First cut		100
Dehydrated		80
Bailed for mow curing		30
After mow curing in bale		16
Field cured		15
Field cured and rained on		1

fat figures are slightly lower and the fiber slightly higher than average.

Length of storage too is a factor in the composition of alfalfa meals. One-half to three-fourths of the carotene may be lost while in storage.

TABLE 44. COMPOSITION FOR VARIOUS ALFALFA FEEDSTUFFS

FEEDSTUFF	VITAMIN A, U.S.P. UNITS PER POUND	MILLIGRAMS PER LB.				PER CENT				
		Ribo- flavin	Nia- cio	Panto- thenic acid	Cho- line	Pro- tein	Fat	Fiber	Cal- cium	Phos- phorus
Alfalfa leaf meal (dehydrated).....	100,000	8 00	24 0	17.0	450	20	2.0	18.0	1 90	.22
Alfalfa leaf meal (sun-cured)	80,000	7 00	23 0	16 0	400	20	2 0	18 0	1 90	.22
Alfalfa meal (dehydrated)	60,000	7 00	22 0	17 0	400	17	1.5	27 0	1 50	.20
Alfalfa meal (dehydrated)	40,000	7 00	18 0	16 0	400	15	1.5	30 0	1 50	.20
Alfalfa meal (either-type).	15,000	5 00	18 0	12 0	.	13	1.5	33 0	1 20	.20

Sun-cured hay for meal is lessened in its carotene or pro-vitamin A. This is not due to the sun or heat but to the action of enzymes which become destructive with the escape of moisture after the plant is cut. On the other hand the sun-cured product is higher in vitamin D than the dehydrated meal. There are 225 units of vitamin D in one pound of dehydrated meal, while the sun-cured contains about 750 units. The vitamin D content of the alfalfa products is extremely variable. In practice it is inadvisable to sun cure to the extent that vitamin D builds up very much, since losses in carotene and other nutritive properties would more than offset the gains.

Good alfalfa meal contains 18 per cent protein, 38 per cent nitrogen-free extract, 18 per cent crude fiber and 10 per cent ash. The difference in composition as compared with the hay is indicated by the fact that hay contains 28 per cent of fiber.

As indicated previously good alfalfa meal is rich in carotene and the B-complex vitamins, under some conditions it has appreciable amounts of vitamin D. It is also a good source of the essential amino acids, lysine, tryptophane, methionine, and arginine. There is some indication that it may carry the animal-protein factor. It is also a rich source of calcium and contains a fair amount of phosphorus.

Low-quality alfalfa meal is high in fiber and comparatively low in protein and the protective nutrients. Meals from poorer than average alfalfa hay should not be used in mixed supplements for pigs. The poorer alfalfa should be used for sows and the best for the pigs.

Feed saved by alfalfa meal. The feed saved by alfalfa meal in a dry-lot ration would be effected by many conditions. It can make a big feed saving. In one trial at Illinois 100 pounds of dehydrated alfalfa meal fed saved 136 pounds of corn, 50 pounds of soybean oil meal, 4.5 pounds of meat and bone meal and 1.2 pounds of minerals. As adding alfalfa meal saves feed, it also safeguards the health of the pigs and promotes faster gains.

Comparison of hay meals. Several hay meals are used in swine rations. That dehydrated alfalfa hay meal ranks high is indicated from a summary of two tests at the U. S. Department of Agriculture. Pigs were fed from 65 to 125 pounds on dry-lot. Ten per cent of the ration was made up of the legume meal. The pigs on the dehydrated meal gained 9 per cent faster on 8 per cent less feed than those on the sun-cured hay meal. The latter was about the same as soybean hay meal, and Kudzu meal. *Sericea* meal was less valuable. The ground hays up to the 50 per cent level can save considerable concentrates in feeding growing and fattening pigs. Soybean hay is valuable in this respect.

In a test at the Kansas station dehydrated *brome-grass*-meal-fed pigs slightly excelled the dehydrated alfalfa meal fed pigs in the rapidity and economy gains. The brome grass meal had a high protein content, 20.9 per cent.

How much alfalfa meal to feed. On dry-lot it is commonly recommended that at least 10 per cent good alfalfa meal be included in the ration for growing and fattening pigs. More would be advisable if the meal is relatively cheap. Alfalfa meal is fibrous and when fed in excess or with other fibrous feeds like oats they may be slowed down.

Two tests from the U. S. Department of Agriculture bear on this point. This was a dry-lot test with growing and fattening pigs.

TABLE 45. DRY-LOT TEST WITH ALFALFA MEAL FOR GROWING AND FATTENING PIGS

PER CENT ALFALFA MEAL IN RATION	AVERAGE DAILY GAIN	TOTAL FEED FOR 100 POUND GAIN
0	1.60	358
5	1.74	378
10	1.72	378
15	1.64	394
20	1.56	405

It will be noted that the 5 and 10 per cent levels were about the same. Those groups gained faster but required more feed for gain than the no-alfalfa lot, but less than greater quantities of alfalfa. In a series of trials at the Wisconsin Station comparing 5 per cent alfalfa hay with 15 per cent on dry-lot for growing and fattening pigs, it was found that the gains were practically the same. The lots receiving the greater amount of hay require more feed for gain, but gains were made at a somewhat less cost. Ground alfalfa hay is usually cheaper than concentrates. Fifteen per cent alfalfa is more desirable than less for breeding gilts. Even on good pasture including alfalfa leaf meal in the mixed supplement up to the 10 per cent level of the supplement is not objectionable and may be economical.

MIXED-PROTEIN FEEDS

Supplemental mixtures. Several supplemental mixtures have been previously suggested and brought out in the discussion of the individual protein-rich feeds. The matter of their use in combinations has been given consideration.

A protein-rich supplement is considered necessary for economical pork production with the usual feeds on American farms. Many hogs are fed with little or no supplemental feeds. However, the daily gains are increased and the feed requirement for a unit of gain decreased if the ration contains sufficient protein supplement. When pasture crops are used, the need for a protein supplement, such as milk or tankage, is reduced. Good leguminous pasture reduces the requirement approximately 50 per cent. Yet at the usual price of feeds it is often more profitable to allow a supplement, nr most likely a supplemental mixture, to supply body-building material. More rapid gains and a lower feed requirement account for the greater margin per pig over feed cost when the protein supplement is allowed.

Composition of a protein supplement mixture. In making a supplemental mixture it is well to consider the conditions under which it will be fed and also the kind of hogs. Dry-lot mixture should contain alfalfa meal or a similar material. Even on pasture the incorporation of 5 to 10 per cent alfalfa meal in the supplement at times proves to be beneficial. In many mixtures the mineral and vitamin carriers are included.

Certain features of composition are to be considered in compounding suitable supplement. Following are some suggested compositions for mixtures.

1. Brood sows	Composition per cent
Protein	35-40
Fat	3-5
Fiber	8-12
Calcium	2.5-3.5
Phosphorus	1.0-1.5
2. Growing and fattening pigs	Composition per cent
Protein	35-45
Fat	3-5
Fiber	8-15
Calcium	2-3
Phosphorus	1.25-1.75

On dry-lot the fiber content is at the upper limit because of the alfalfa meal included. Mineral content would be ample if 3 to 5 per cent of a mineral mixture is incorporated in the supplement. Vitamins A, D, and B-complex carriers are to be added when dry-lot feeding is practiced. Less attention need be given to the mineral and vitamin content of the mixture if the feeding is on good pasture.

Content of supplemental mixtures. A great variety of feeds high in good-quality protein is available to balance the grain commonly fed. Most of the feeds used for the basis of swine rations have characteristics somewhat similar to those of corn. They present many of the same deficiencies. Because of these deficiencies they are not adapted to use as the entire ration. Combinations of these grains, such as corn, barley, oats, wheat, etc., are but little better than a single grain for the sole ration. Pigs need other materials for rapid growth. Further, sows require a balanced ration.

The deficiencies of these grains, which are chiefly in protein, mineral matter, and vitamins, can be overcome by using them with feeds well fortified in these properties. The corn and tankage combination is a notable simple example of such a supplementation. This combination was long used as a standard of comparison. Yet it has been found that this ration could also be improved with certain changes, mainly along the line of introducing the dietary factors in a more adequate supplemental blend of feeds or supplemental mixture.

Often an objection to such feeds as mixed-protein feeds is that they are too high in price. Yet when converted to the basis of the grain saved, their value can be appreciated. On this replacement basis a high price is most often justified. In swine-feeding trials where corn alone has been compared with corn and tankage, both rations being self-fed, free-choice system, 100 pounds of tankage has replaced or saved from 400 to 700 pounds of corn. Too often the feeder considers the cost of the supplement and not the worth of the feed replaced by it.

Feeds included in the supplemental mixtures. Combinations of high-protein feeds very often eclipse the single supplement in

making the corn crop pay in the form of marketable hogs.

The Trinity mixture, composed of tankage 50 parts, linseed meal (o.p.) 25 parts, and alfalfa meal 25 parts, has repeatedly excelled tankage in comparative feeding trials. In 21 experiments summarized by Morrison for pigs not on pasture, pigs on the Trinity supplement gained 1.35 pounds per pig daily, while in the contrasting group average where tankage alone was the supplement the daily gain was 1.17 pounds. One hundred pounds of the mixed supplement saved 70 pounds of tankage and 52 pounds of corn.

When hogs are fed on pasture, the alfalfa meal should be reduced or omitted from the mixture, as a forage crop of good quality may supply the essential parts contributed by the meal. Some successful all-year supplements contain up to 10 per cent alfalfa leaf meal. As pigs grow and increase in size, it is well to reduce the alfalfa in this mixture. The feeder must try to get the optimum amount of the meal. Its content of vitamins, mineral matter, and excellent quality protein add materially to usual swine relations. If pigs are doing well on dry-lot, it is safe to reduce the alfalfa in the mixture. However, for unthrifty, slow-gaining pigs, 25 per cent alfalfa in the supplement will not be too high. Because of the fiber content the alfalfa meal should be kept at a minimum but on dry-lot about 10 per cent good alfalfa meal is needed in the ration for best results.

The hog is an efficient converter of concentrated feeds into pork products and is not adapted to the utilization of coarse, bulky feeds high in fiber. Liberal feeding is in most instances the most profitable; rapid gains the most economical. A short feeding period makes it possible to take advantage of a high market. Heavy allowances of concentrated feeds are, therefore, indicated for growing and fattening pigs.

The feeder should consider all the feeds available in choosing or preparing a supplemental mixture. For example, if cottonseed meal of the choice grade is available at a low price, some could be used to good advantage. Soybean oil meal, peanut meal, gluten feeds, corn-germ meal, dehulled oats, wheat middlings, and other feeds merit consideration in compounding a supple-

mental mixture. The nutrient content quality and cost of these feeds should be carefully considered.

Tankage, or fish meal, or a combination of the two should make up about 40 per cent of the mixture. They rank as a supplement. They are superior to vegetable feeds of high-protein content. However, the vegetable feeds which were mentioned before give cheaper costs and usually greater gains. Fish meal is slightly better than tankage in the mixtures. Linseed meal is of known merit and under most circumstances should be included when economical. Soybean oil meal of good quality is equal to the linseed oil meal in the Trinity mixture while cottonseed meal, corn-germ meal, corn-gluten meal, and wheat middlings are usually worth somewhat less—although the good effects from the Trinity supplemental mixture come mainly from the alfalfa hay.

Following are some of the modifications of the Trinity mixture which have given good results:

A. For dry-lot feeding

1. Tankage	40
2. Linseed oil meal	20
3. Cottonseed meal	20
4. Alfalfa meal	20

For brood sows

1. Tankage	65
2. Alfalfa meal	35

For suckling sows

1. Tankage	25
2. Soybean oil meal	30
3. Linseed oil meal	10
4. Alfalfa meal	32
5. Mineral mixture	5

For pigs 150 pounds and over

1. Tankage	65
2. Linseed oil meal	25
3. Alfalfa meal	10



This self-feeder is in operation. A section in a self-feeder can be used for the protein-mineral-vitamin supplement.

B. For feeding on good pasture

1. Tankage	60
Linseed oil meal	40
2. Tankage	75
Linseed oil meal	12½
Cottonseed meal	12½
3. Tankage	50
Linseed oil meal	50

Mineral mixtures are added to these mixtures at times and usually from three to five pounds is mixed with 100 pounds of the supplement feed.

More complex supplemental mixtures. When a mineral mixture is combined with the protein supplemental mixture a rather complex mixture less adapted to home mixing results. There are many such mixtures. The "Big Ten" is a common one in this group. It is made up of the following ingredients: tankage, 40 pounds; linseed meal, 15 pounds; alfalfa meal, 12.8 pounds; cottonseed meal, 20 pounds; peanut meal, 9 pounds; salt, barrel, 1 pound; limestone, high calcium, ground, 1.5 pounds; iron oxide, 0.198 pounds; wood ashes, 0.5 pounds; and potassium iodide, 0.002 pounds; total, 100 pounds.

This mixture contains 42.8 per cent protein and for growing and fattening pigs it is commonly self-fed.

At the Ohio Experimental Station an "All Purpose" supplement suitable for other classes of farm animals has been developed. It is composed of the following materials:

Dried rendered tankage	30
Soybean oil meal	30

Cottonseed meal	20
Linseed oil meal	15
Ground limestone	2
Steam bone meal	2
Common salt	1

In using the above mixture on dry-lot there needs to be an alfalfa meal addition. One of the best protein supplements of U. S. Department of Agriculture Research Center Beltsville, Maryland is composed of the ingredients in the quantities listed:

Fish meal good quality	10
Tankage high grade	10
Soybean oil meal toasted	35
Linseed oil meal	20
Alfalfa meal	20
Mineral mixture	5

Purdue mixed supplements. Some excellent mixed supplements have been developed at the Purdue Agricultural Experiment Station. Supplement 5, containing 20 pounds of meat and bone scraps, 20 pounds of fish meal, 40 pounds of soybean oil meal, 10 pounds of cottonseed meal, and 10 pounds of alfalfa leaf proved to be highly efficient for growing and fattening pigs both on dry lot or on pasture, as measured by rate and economy of gain.

Balanced supplements. As the term implies, such supplements, which are largely commercial, contain all of the known nutritive needs for swine. Included in the components are vitamins, minerals, and antibiotics. These are usually in pre-mixes, as the quantities required are very small. For example, the mineral mixtures which are made up of basic materials like common salt, bone meal, and ground limestone are fortified with the trace minerals added in the form of a premix that is mixed with some carrier to insure even distribution. The trace minerals which could be lacking in swine rations are iron, copper, cobalt, manganese, iodine, and perhaps others.

In complete supplements, carriers of the fat-soluable vitamins are incorporated to include vitamins A and D₂. The latter is provided by irradiated yeast, and synthetic forms and fish oils are common sources of the former for the feed mixers.

As indicated previously, the B-complex vitamins can be limiting factors in rations; as a consequence, those not widely distributed in the natural feeds are often incorporated in complete supplements. Among the needed B vitamins are riboflavin, niacin, pantothenic acid, pyridoxine, choline, B₁₂, and others. While some feeds contain various amounts of these vitamins, it is common practice for mixed feed manufacture to incorporate synthetic forms in supplement feed. See chapter 13.

Antibiotics. Under certain conditions the antibiotics, such as aureomycin (chlortetracycline), terramycin (orytetracycline), and procaine penicillin, may be growth-stimulating for swine. They are added to feed in premixes and in the quantity to result in about 5 milligrams per pound of ration. Improvement in rate of gain and response to the feed will occur in most instances with swine, particularly with young pigs under adverse conditions. The beneficial effect of antibiotic feeding is widely recognized, and there is widespread use of these materials in swine feeding. The antibiotic at a feeding level should not be looked upon as a substitute for an inadequate ration or poor management.

Runty, poor-doing pigs profit the most from antibiotic ration additions, and for them higher than the usual level of feeding is recommended. Young pigs get the greatest benefit from antibiotics, but it also is known that they may be advantageous in brood-sow rations. Since very small quantities are involved, the swine feeder must depend upon commercial supplies for antibiotic fortified feeds.

Pelleting supplements. Protein supplements in pellet form are now available. The pellets have some advantages over the meals. They will not blow in winds as easily as meal type feeds. They will not shift through cracks in feeders, also under some conditions they are more convenient for mixing. In one trial

(Illinois) the following supplement was fed in the meal and pellet form, to different lots.

Meat and bone scraps—50 per cent crude protein.....	30 pounds
Expeller soybean meal.....	38 pounds
Alfalfa meal, dehydrated.....	20 pounds
Dried corn distillers' solubles	10 pounds
Iodized Salt.....	2 pounds
<i>Total</i>	100 pounds

The supplement as well as yellow corn was self-fed free-choice style on dry-lot. The pellets were $\frac{3}{8}$ inch in diameter and were $\frac{1}{2}$ to $\frac{3}{4}$ inch long. The gains were not significantly different but the pellet-fed lot consumed 6 per cent less feed. In a comparison of the feed needed for 100 pound gain it was determined that 100 pounds of the pellet supplement saved 107.6 pounds of meal supplement plus 39.8 pounds of corn.

COMMERCIAL FEEDS

Commercial feeds are those which are purchased by the feeder and embrace a wide group of feeding materials. On very few farms are all of the feeds available for a complete ration. Even the feeder who is fortunate enough to have corn and soybeans, or grain and skim milk, must make some provision for mineral feeds. Feeds which are commercial in one locality, for swine, may not be commercial in other localities. Where milk products are plentiful, the hog raisers buy basal feed, such as corn; whereas where corn is plentiful, protein-rich feeds such as tankage are purchased.

What is included in commercial feeds. From the uniform feed law it is found that the term "commercial feeding stuff" shall be held to include all feeding stuff used for feeding live-stock and poultry, except whole seeds or grain; the unmixed meals, made directly from the entire grains of corn, wheat, rye, barley, oats, buckwheat, flaxseed, kafir, and milo; whole hays; straw cottonseed hulls; and corn stover when unmixed with other materials. Wheat flour or other flours fit for human consumption are not included.

Stock tonics form a class of commercial feed such as medicated stock or poultry foods, including such preparations as are com-

posed wholly of drugs which contain any substance claimed to possess medical, condimental, or nutritive properties.

Mineral mixtures are also classed as commercial feeds.

Commercial feed terms. Several terms are used with regard to commercial feed. The common ones are as follows:

Closed-formula feed. A feed in which the formula is not given although the chemical composition may be listed on the feed-law label. The amount of each ingredient is not shown.

Open-formula feed. Open formula feed is feed which lists on a label or has branded on the sack the amount of each of the various ingredients used in making-up the feed.

Condimental stock feed. Condimental stock feed is practically the same as a stock tonic.

Feed mixers. Feed manufacturers are of two types:

1. The feed dealer is often a feed mixer or commercial feed manufacturer, mixing feed in addition to his retail feed business, in accordance with the requests of his customers. A hog raiser can go to his local feed dealer to have him mix up such feeds as supplemental mixtures, pig starters, and similar mixtures.

2. The large feed manufacturers mix proprietary feeds or open formula feeds. Their formulas involve many ingredients and these are blended into a rather uniform mixture. The formula used is usually carefully selected and made of high-grade materials.

Home-mixed versus factory-mixed feeds. Home-mixed feeds usually cost less than factory-mixed feeds of the same composition. This is due to the expense of distributing the factory-mixed feed, as there is not much difference in the cost of the ingredients and the cost of mixing. Factory-mixed feeds usually have a uniform mix and are, in most cases made of more uniform ingredients. They may also be free from foreign materials like nails, as these are usually removed in the process of manufacture. It is also possible for the large maker of feed to buy in larger quantities and at lower prices than the farmer mixing his feed. Most commercial feeds contain only high-grade materials, but some contain materials inferior from a feeding standpoint.

Screenings, oat hulls, and other materials are included in some feeds.

In deciding between home-mixed and factory-mixed feeds the feeder must consider the relative composition and cost, and also the intelligence, efficiency, and honesty of the feed mixer.

Feed laws. The federal government has regulatory measures regarding the sale of stock feeds. However, the feed provisions of the National Food and Drug Act do not require the labeling or branding of feeds. Most states have laws pertaining to the sale of commercial feeds within the respective states. The purposes of a state feed law are as follows:

1. To require all feeds as defined to be registered, labeled, and branded so as to show their value and composition.
2. To protect the consumer against short-weight, misbranded, adulterated feeds.
3. To protect the honest manufacturer and dealer from unfair and dishonest competition.
4. To assist the farmer and stock feeder in the selection of economical and suitable feeds.

Most state laws require a statement of minimum percentage of protein and fat, and the maximum percentage of crude fiber. A statement of the minimum nitrogen-free extract content is usually not required.

Vitamin labeling of commercial feeds. The labeling of feeds to show their vitamin values is practiced by some. The Association of American Feed Control Officials have decided upon a uniform basis for separation of vitamin potency which is as follows:

Vitamin D. For poultry feeding vitamin D is to be expressed in chick units per pound. Vitamin D₂ which is the irradiated product and used for four-footed animals will be expressed in U.S.P. units per pound.

Vitamin A. Vitamin A will be expressed in U.S.P. units per pound. This is the same as International Units.

Other vitamins. All vitamins other than A and D will be expressed in milligrams per pound.

Buying feeds. The buyer of feeds should study the composition of feeds as shown by the label; the ingredients included, if a mixture; and if possible, secure experimental data on the various feed available. Data from experiments are the best criteria as to the nutritive value. Oftentimes, however, they are not available, especially on a mixed feed.

Experimental trials on commercial feeds are seldom conducted at the state stations because feed put out one year under a certain trade name may be changed in the coming year, and certainly will be if it has made a poor showing in a feeding trial.

Such unmixed feeds as linseed meal and cottonseed meal of stated grade and composition have their nutritive value quite well established by experimentation. Chemical composition is a fairly reliable index to value. Testimonials and opinions of feeders concerning feeds should be accepted only in the absence of definite facts.

Stroud, in *Commercial Feeds*, gives two general rules to follow in purchasing feeds:

1. Do not experiment with feeds which have less protein and more fiber than are contained in the home mixtures recommended to supplement the available home-grown feeds.
2. Do not patronize manufacturers whose feeds are shown by state inspection bulletins to fail continually to meet their guaranteed analysis.

To these rules might be added another precaution in buying: Do not buy feeds which are high in energy materials (carbohydrates and fat) unless they furnish these nutrients cheaper than home-grown feeds.

Feed comparisons based on composition.

1. The nutritive ratio of the feed indicates relation between the protein and carbohydrate equivalent. It is of value in determining how a feed might balance with other feeds. As most hog producers have to buy high-protein feeds, the feeds they select have a narrow nutritive ratio, like oil meals and tankage. The ratio may be taken as an indication as to how the feed will affect the nutritive ratio of the other feeds in the ration.
2. The percentage of crude protein is quite a reliable guide

in measuring supplemental value. However, it is not always a correct estimate of value. For example, dried blood is higher in crude protein than tankage, yet the latter is superior in balancing a basal ration of corn for pigs.

3. The fat content assists the buyer in evaluating the nutritive value of a feed.

4. The fiber content information too is some help, as the pig ration can be excessively fibrous.

5. Vitamin content of a feed indicates how it might be of value in supplying the vitamin deficiency in rations.

There are other factors too that influence the value of a feed. Knowing the protein, fat, and crude fiber of a feed is not the complete story of the nutritive values.

SUGGESTIONS FOR FURTHER STUDY

1. Determine what supplemental feeds are used by swine feeders in your locality.

2. Make a comparison of the costs of the different protein supplemental feeds offered for sale in your county.

3. Make a list of the sources of supplemental feeds.

4. Collect samples of different feeds and also the feed tags attached to the feed bags.

5. Determine the proportion of farmers in your section which include supplemental feeds in their swine rations.

6. Determine the extent of feeding alfalfa meal, alfalfa hay, and other leguminous meals.

REFERENCES

- MAYNARD, L. A. *Animal Nutrition*. McGraw-Hill Book Co., New York
- MORRISON, F. B. *Feeds and Feeding*. The Morrison Publishing Co., Ithaca, New York
- SMITH, W. W. *Pork Production*. The Macmillan Co., New York
- United States Department of Agriculture:
Food and Life, Yearbook of Agriculture
- WHERRY, LARRY. *The Golden Anniversary of Scientific Feeding*. Business Press, Milwaukee, Wisconsin

CHAPTER 13

Mineral and Vitamin Supplements

NOT INFREQUENTLY the mineral and vitamin carriers are incorporated into swine rations particularly in the mixed supplement feeds. So important are these phases of feeding that this chapter is devoted to them.

The mineral and vitamin requirement for swine of various classes is given in the Appendix. There is also the mineral and vitamin composition of swine feeds. There are two divisions to this chapter: (1) mineral supplements and (2) vitamin supplements.

MINERAL SUPPLEMENTS

Minerals are those materials other than carbon that remain in the ash when a feedstuff is burned. They are called inorganic nutrients. Actually the feeding of suitable minerals can have a material effect upon swine. For example some do not feed salt to pigs. Yet a big saving of feed can be made by ample salt feeding. In one striking comparison made at the Iowa Station with salt-fed pigs compared with a lot not given salt, it was found one pound of salt saved 633 pounds of feed in addition to the saving in labor, housing, interest, risk, and other cost because the salted pigs went to market so much faster. Mineral supplements for sows are discussed in Chapter 7.

Use of minerals in the body. Minerals makeup a part of the animal body. Also they perform many essential functions. Many have specific uses such as iron in the prevention of certain types of anemia, and iodine in the prevention of simple goiter. They

perform a host of functions, some of which are quite complex. The mineral intake can have a marked influence upon the rate of growth, health, and the utilization of the organic nutrients. When the allowance of minerals is insufficient for pigs on pasture there will be more than the usual amount of rooting. This will happen also with insufficient protein.

Mineral composition of the pigs. Minerals become a part of the body of the pig, forming bones and other structures, the inorganic or mineral nutrients makeup from 2 to 3 per cent of the weight of swine. The following from the U.S.D.A. 1939 Year-book gives information on the mineral composition of the pig.

The body of a 225-pound pig contains approximately five pounds of ash, or mineral material. Of this amount nearly four pounds is in the skeleton, about 0.8 pound in the meat, about 0.2 pound in the organs including the alimentary tract, and slightly less than 0.1 pound each in the skin and the blood. Calcium and phosphorus are the two predominating inorganic elements in the skeleton as well as in the entire body. Following are some estimates of the total quantities of the more common mineral elements in a 225-pound pig:

	<i>Pounds</i>		<i>Pounds</i>
Calcium.....	1.46	Sodium.....	0.16
Phosphorus . . . . .	.88	Chlorine . . . . .	.13
Potassium. . . . .	.34	Magnesium . . . . .	.06
Sulfur.....	.20	Iron... . . . .	.03

Smaller quantities of copper, manganese, iodine, cobalt, and zinc are to be found. All the elements named are known to be required in the nutrition of certain animal species, but the need for adding manganese, cobalt, and zinc to swine rations is uncertain. The requirements are undoubtedly very low and the usual diversified ration probably contains adequate amounts.

Mineral elements needed. The presence of an element in the body does not necessarily indicate that it is essential. There are several inorganic or mineral elements which are regarded as essential. The major ones are calcium, phosphorus, potassium, sulfur, sodium, chlorine, magnesium, and iron. Mineral com-

positions of feeds usually include these. Others which are essential are copper, manganese, iodine, cobalt, zinc, and flourine. Need for the last three in swine rations has not been established. Cobalt is needed by ruminants, and flourine apparently functions in normal tooth development. In excess, flourine, like some of the other materials, may be toxic.

Mineral deficiency symptoms. In the index there are the deficiency symptoms listed for the various minerals. Slow or interrupted, reduced appetite are the common symptoms. Slow, costly gains and unthrifty pigs, susceptible to parasites and diseases may result with insufficient intake minerals. Also diseases result, such as rickets, hairless pigs, goiter, and anemia.

Source of mineral nutrients. The natural feed supply contains some mineral nutrients and under some conditions the ration may provide all that is required. Most always rations of natural feeds are short in salt (sodium and chlorine). Commonly they are not completely satisfactory in other minerals. We know that air-dry feeds to be adequate need to have 0.4 per cent calcium, 0.3 per cent phosphorus, and 0.15 per cent of potassium. Vitamin D influences the utilization of calcium and phosphorus (see page 192). Quantities of the other elements are not too clearly defined, but they are needed. If then, these elements are not in the feeds used, mineral supplementation is indicated.

Conditions influence need for mineral feeds. A ration, in which no animal protein feed is included and pasture is omitted, needs a mineral-mixture supplementation. Further such younger pigs and pregnant or suckling sows would be way short of their requirements if only the usual natural feeds are fed. On the other hand heavy pigs fed a good ration on the best pasture probably would have but little need for extra mineral supplementation. Mineral deficiencies are regional. Soils and crops are short in certain elements in some areas and not in others.

How much mineral mixture to put in feed mixture. Commonly mineral mixtures and salt are self-fed apart from other feeds. When the entire ration is mixed and fed as such, about 1 to 2 per cent of mineral mixture is put in the feed. Mixed supplements for swine are often fortified with from 3 to 6 per cent of minerals.

Self-feeding free choice is probably the best method of feeding since it permits a variation of intake. Consumption keeps pace with the requirements.

Excessive intakes are to be avoided. Nothing is gained by making livestock consume excessive quantities.

Mineral mixture consumed. The amount of mineral mixture consumed is governed by the age of the pigs, ration used, and whether or not pasture is included.

TABLE 46. MINERAL MIXTURE CONSUMED PER 100 POUNDS GAIN

WEIGHTS	TANKAGE SUPPLEMENT, POUNDS	SOYBEAN OIL MEAL SUPPLEMENT, POUNDS
Weaning to 75 pounds on pasture....	0.3	4.2
75 to 225 pounds on pasture.....	0.4	3.0
125 to 225 pounds on dry-lot.....	0.6	3.2

If the pigs are gaining one pound per head daily, the daily consumption of mineral mixture would range for the conditions above from .003 to .042 pound.

Should a poor ration be used, like shelled corn alone or whole soybeans used as the sole supplement on dry-lot, the daily consumption could be as high as 0.1 pound of mineral mixture per pig daily.

So many conditions effect the consumption that it is difficult to lay down general rules for mineral mixture consumption. Even the water consumed may be a carrier of certain minerals.

So small is the quantity of some minerals needed in rations that it is expressed in terms of parts of mineral per million parts of feed. There are 453.6 grams in a pound. One milligram or $\frac{1}{1000}$ gram per pound of feed equals 1 part to 454,000 parts. One part per million ratio can be made by using 2.2 milligrams per pound of feed.

Mineral mixture to feed. It is obvious that there is no one best mineral mixture since conditions vary the requirements. A simple mixture will do very well for larger pigs on pasture. The mineral supplemental problem is regional. In some localities for example the inclusion of iodine is not necessary.

Recommendations from the state agricultural experiment station should be secured and followed.

Quite general complex mixtures are employed to guard against a possible deficiency of some of the mineral elements. There is no objection to such procedure. Yet it is folly to include such materials which probably would never be lacking. Also there is no advantage in loading up a mineral mixture with tonics, stimulants, worm remedies, laxatives, conditioners, or flavoring materials.

The following mixtures have given good results in feeding:

A. Simple mixture	<i>Pounds</i>
Limestone high calcium, finely ground	50
Bone meal	30
Salt-common flake	20
 B. Complex mixture	
Limestone high calcium, finely ground	40
Bone meal	32.45
Salt-common flake	25
Iron, ferrous sulphate	2.0
Manganese sulphate	.30
Copper sulphate	.05
Cobalt chloride or carbonate	.10
Potassium or sodium, iodide stabilized	.05
Zinc carbonate	.05

Stabilizing the iodine is essential to prevent loss. Some materials are mixed in the iodized salt which coats the iodine and prevents escape.

Commercial mineral mixtures often contain vitamin D and other vitamins.

Trace minerals. Those mineral substances in small quantities in animals, or feeds for them, are called trace elements. These include iron, iodine, manganese, copper, zinc, cobalt, potassium, and others. These can be obtained blended or premixed with salt or limestone in proper proportion for mixing with limestone and bone meal to form mineral mixtures.

Salt feeding. It is usually good practice to self-feed salt in addition to that which is in the mineral mixture. Self-feeding is a safe practice. In fact salt poisoning appears to be difficult to produce experimentally where ample water is provided.

Iodized salt. Iodized salt contains .0078 per cent iodine as potassium or sodium iodide. Stabilizing of the iodine is necessary for retentions. Iodized limestone is also available for feeding.

Excesses to avoid. Large excesses of minerals may be as harmful as deficiencies whereas moderate excesses are tolerated.

There are certain things to remember in regard to mineral mixture constituents.

1. Excesses of calcium will interfere with assimilation of other minerals.

2. Excess of phosphorus may interfere with iron and manganese.

3. Excess of iron will interfere with manganese and phosphorus.

4. Flourine is necessary, but in excess it effects tooth and bone growth. Phosphorus carriers high in flourine are to be avoided. A mineral mixture for swine should contain not more than .45 of flourine and the entire ration less than .003 per cent.

5. Some mineral substances are detrimental to various vitamins.

6. Selenium as is present in some sections is detrimental.

7. Oxalic acid interferes with calcium utilization.

In conclusion it is well to point out that the toxicity depends not only on concentration in a feed or ration but the duration and manner of feeding, the chemical combination, and the balance of nutrients.

VITAMIN SUPPLEMENTS

Vitamins are organic compounds that are essential constituents of the ration, but are required in only minute quantities. They are required for normal functioning of the body. Some are designated by letters, but the tendency is to designate these materials by their scientific names. So small is the amount in

feeds, that the quantities are expressed in terms of units or milligrams per pound of feed.

To date our information on vitamins is still incomplete but we have acquired much information on this subject.

Results of swine feeding can be influenced by the presence or absence of the vitamins. Their absence from the ration when severe may cause deficiency diseases. These symptoms from common vitamin deficiencies are also included in the Appendix page 518, Table 77. Of course in feeding before deficiency symptoms appear, the results of deficiencies may effect gains in rapidity and economy.

Seldom do we use the pure vitamins in swine rations, but the special concentrates like the fish oils or irradiated yeast are fed. These supplement the other feeds. The requirements of swine and the composition of feed including the vitamins A, D, and B-complex vitamins—thiamine, riboflavin, niacin, pantothenic acid, and pyridoxine—are in the Appendix.

Vitamin-D supplements. There are several materials which have antirachitic properties. The two important ones in the feed supply are:

1. Vitamin D₂ (calciferol or irradiated ergosterol) is the form found in plants, as sun-cured hay and irradiated yeast.
2. Vitamin D₃ (Irradiated 7-dehydrocholesterol) is the form found in animal materials such as fish oil and irradiated milk.

Investigations at the Ohio Agricultural Experiment Station have revealed that both forms of vitamin D are equally efficient for swine. Apparently it makes no difference whether pigs received the vitamin D from irradiated yeast (D₂), or cod-liver oil (D₃). The choice when a source is needed is to be on the cost units considered.

Vitamin D needed. Ohio Investigators have determined that the minimum practical requirement of growing and fattening pigs fed a ration containing 0.6 per cent calcium and 0.45 per cent phosphorus and not exposed to sunlight is on the order of 90 U.S.P. units per pound of ration. A 100-pound pig then consuming 5 pounds of feed would need 450 units of vitamin D daily. The need is influenced by the feeds, their composition,



Here is a pig nursery. This forrowing pen is set aside for the pigs in order to protect them from the sow. Special feeds can be given to the pigs here, and the ratio between calcium and phosphorus. It should be pointed out again that requirements may be met with sunlight exposure.

Feeding indoors. In the absence of sunshine and vitamin D in the ration rickets usually develop in about one month's time. As indicated previously most natural feeds are low or devoid of vitamin D. Even sun-cured alfalfa is quite irregular in its potency. Consequently, when feeding indoors, or when sunshine is irregular there may be a deficiency on a fairly good ration.

White pigs because of the deeper penetration of the sun rays will store up twice as much vitamin D as black pigs when exposed to sunlight. Therefore black pigs will develop rickets sooner when fed indoors after the pasture season than white pigs.

Rickets described. Wm. J. Leoffel of the Nebraska Agricultural Experiment Station has given the following excellent symptom description of rickets in pigs.

"Some of the symptoms observed were as follows: stiff and stilty gait (*cross-legged behind*); inability to walk (*crawling on knees*); trembling when forced to move; nervousness and irritability; knuckled over at knees; front pasterns very upright; hind pasterns 'down' (*walking on dew claws*); legs bowed; back extremely arched; hair long, coarse, and rough; and general condition poor."

Vitamin-D supplements. The farm operator needs to be alert for conditions under which rickets occur for it is one of the most common of the nutritional diseases in swine in the corn belt. Young pigs may not be sunlight exposed during winter in northern sections sufficiently to avoid rickets.

In the event of feeding under conditions which would be productive of rickets a vitamin-D carrier like irradiated yeast, fish-liver oil, or irradiated sterols should be added to the ration. When mixed with feeds there is some loss of potency on storage.

When irradiated dry yeast is incorporated in the winter rations one pound of the material is added to one ton of supplement. As a result the supplement will contain 2000 units of D per pound. Therefore .65 pounds of such supplement daily would be ample for all of the vitamin D for a 50-pound pig.

Vitamin-A supplements. Carotene found in plants is the precursor of vitamin A. Carotene content is often given for feeds and also for swine requirement. The U.S.P. unit of vitamin A is equal to 0.6 microgram of beta-carotene. Vitamin A is the animal form. Swine do not use carotene as efficiently as vitamin A. Approximately two and one-half times as many units of carotene as true vitamin A are required. In the animal the carotene is converted to vitamin A in the liver. Green pasture, dehydrated-hay meals, and yellow corn are good carotene or pro-vitamin-A supplements. Dried cereal grasses, fish oils, liver meal, carrot oil, and carotene are particularly potent sources for special supplements.

Certain feeds especially the animal by-products, such as meat scraps, tankage, dried fish, and milk, have a carotene-destroying power. Seldom do the vegetable feeds have carotene-destroying



This is a simple alfalfa self-feeder for pigs.

power. Feeds decline in vitamin-A value upon storage. Some carotene is also destroyed in the intestine.

Vitamin A needed. The recommended nutrient allowance for swine lists the vitamin A need from 1,300 I Units for a 50-pound growing and fattening pig up to 26,000 I Units for lactating sows and breeding boars. For the 50-pound pig 3,300 I Units would be needed if carotene (2.0 mgms.) is used for the source. The interrelation of the vitamins is illustrated by the fact that vitamin E has a beneficial effect on vitamin-A utilization.

In the absence of a sufficient amount of vitamin A in the ration, night blindness occurs. This happens before gains are effected. Beyond the affliction of the eyes other symptoms appear such as diarrhea, muscular non-co-ordination, susceptibility to respiratory infections, and hind-leg paralysis. With sows, conception, gestation, lactation are effected. Sows on A-deficient rations may produce pigs with eye defects.

When feeding without pasture, alfalfa meal, or yellow corn, there may be a vitamin-A deficiency if ordinary feeds make up the ration. Animals can store this vitamin so the immediate effects of a deficient ration will not be noted.

B-complex vitamins. The distribution of the B-complex vitamins in feed is given in the table of composition of feed in the Appendix. Also the requirements are given. The synthetic materials such as thiamine, riboflavin, niacin, pantothenic acid, pyridoxine choline, and others are at times incorporated in swine-feed mixtures. A knowledge of the good source in common feedstuff and a special supplement or concentrate is essential to avoid B-complex deficiencies. The symptoms from B-complex deficiencies are listed in the Appendix page 518, Table 77. They will not be repeated here. However there follows a discussion of the B-complex vitamin members and their significance in swine feeding. Also their sources for swine feeding is included.

1. *Thiamine or B₁.* B₁ is widely distributed in the pork as one of the richest sources of thiamine for humans but the amount in pork is dependent upon the ration. Grains, grain by-products, and oil seed by-products are all good sources. Dried brewer's yeast, liver meal, and seed germs and concentrated sources.

2. *Riboflavin.* Riboflavin may be lacking in usual swine rations, particularly on dry-lot when alfalfa meal or a similar feed is omitted. Milk, pasture, and alfalfa meal are good sources. The rich concentrates are dried brewer's yeast, liver meal fermentation solubles, condensed whey, and fish solubles. Results have been conflicting on the amount of this vitamin required. Earlier experiments indicated that .75 milligram of riboflavin per pound of ration was sufficient, however more recent work indicates that it should be higher at least with weaning depleted pigs. For such pigs 1.43 mg. per pound of feed is suggested.

3. *Niacin.* Rations consisting mainly of corn as the common supplement lack of niacin. As a result, pig pellagra may occur on such rations. See page 314. When the ration is ample in the essential amino acid tryptophane less niacin is needed. Good sources are wheat and by-products, barley, peanut oil meal, and meat scraps. Concentrate sources are dried brewer's yeast, fish solubles, rice polishings, and liver meal. Very young pigs have a higher requirement than older pigs, while 2.5 mg. niacin

per pound of ration is ample for pigs after weaning, suckling pigs require at least three times as much.

4. *Pantothenic acid*. A lack of pantothenic acid may occur in dry-lot feeding. The good sources are good alfalfa meal, pasture, condensed milk by-products—including whey, peanut meal, cane molasses, dried brewer's yeast, and liver meal. About 3.7 milligrams of pantothenic acid are required per pound of feed.

5. *Pyridoxine*. Pyridoxine is one of the dietary essentials for some. However swine rations are seldom, if ever, lacking in this vitamin. Many feeds contain good supplies of pyridoxine. Grains, soybean oil meal, alfalfa, animal products, dried brewer's yeast, liver meal and rich bran, molds, and bacteria living on pen floors provide this vitamin for pigs. Six-tenths milligrams per pound of feed is sufficient.

6. *Choline*. Choline is essential but probably most swine rations contain a sufficient amount. Bred gilts on a choline-deficient ration farrowed abnormal pigs. Meat scraps and tankage are excellent sources. The actual requirements are not known. However 450 mg. of choline per 100 pound live weight is adequate for pigs. The need is related to the essential amino acids, methionine and cystine.

7. *B₁₂*. This antipernicious-anemia factor is the major part of what formerly was the "animal-protein factor." It may be lacking in some swine rations. Vitamin-B complex and antibiotic premixes commonly carry B₁₂. The requirement is about 5.0 micrograms per pound of ration.

Other vitamins. Other vitamins like E, the antisterility vitamin, and K, the antihemorrhagic vitamin, are required, but they are common in ample amounts in swine rations.

Para-amino-benzoic acid is needed by young pigs and sucklings sows. Under certain conditions deficiencies occur.

Biotin and inositol. But small amounts of biotin and inositol are necessary. Rations usually contain sufficiency for swine. These are furnished by intestinal bacterial action.

Folic acid. In order to have a ration insufficient in folic acid it is necessary to feed an antagonist such as the sulfa drugs.

Pig pellagra. A severe diarrhea may result from a lack of niacin in rations for pigs. Also there is loss in weight, an unhealthy skin, and sometimes a difficulty in the use of the hind legs. In practice this condition occurs on a ration made up

mainly of corn. Tryptophane will help the low-protein corn ration. It is thought the intestinal bacteria converts the essential amino acid tryptophane into niacin. With ample tryptophane in the ration less niacin is needed.

While the symptoms of pig pellagra are not unlike necrotic enteritis it should be pointed out that the latter is a chronic form of specific infection. See Chapter 22. If there is a nutritional deficiency, infections like necrotic enteritis may be more severe or last longer. Adequate ration nutritionally will prevent deficiency diseases and may give greater resistance to certain diseases.

SUGGESTIONS FOR FURTHER STUDY

1. Determine the extent of feeding mineral and vitamin supplement to swine.
2. What ingredients are included in mineral mixtures offered for sale? Also from the tags on the sacks determine the composition.
3. Make a study of the comparative costs of the different commercial mixtures.
4. Make a study to determine to what extent mineral mixtures are home mixed. What are the advantages and disadvantages?
5. Survey farmers in your area that are swine feeders to determine to what extent rickets and pig pellagra occur in your locality. What are the common control methods?

REFERENCES

- The Feed Bag Red Book*, Buyer's Guide. Editorial Service Co., Milwaukee, Wisconsin
- MAYNARD, LEONARD A. *Animal Nutrition*. McGraw-Hill Book Co., New York

CHAPTER 14

Pasture or Forage Crops for Swine

THIS CHAPTER will cover the production and management of pasture or forage crops. The use of such crops by swine is covered in Chapter 10. The subject of feeding alfalfa meals and similar substances is in Chapter 12.

The various pasture crops will be discussed individually. Following which there will be the combinations and rotations.

Alfalfa. Alfalfa is, no doubt, the most valuable forage crop grown, in spite of the fact that it is a perennial, which may detract from its worth in conjunction with the clean-ground system. This forage is nearer to the ideal forage than any of the others. Its virtue as a hog forage is based upon its great yields, palatability, the large amount of nutrients, generous amounts of proteins, minerals, and vitamins, and rather constant supply of luxuriant, succulent, low fibrous forage. Alfalfa has a long grazing season and if not heavily grazed will yield a hay crop. It is a soil-conserving crop. However it is not adapted to all soils.

As alfalfa is the best of forage and high in supplemental value, it is the first choice to use as a single forage addition to common basal feeds. In fact, for breed sows, a corn-alfalfa forage ration is satisfactory during the summer rest period.

Management of alfalfa pasture. The only precautions necessary in pasturing alfalfa with hogs are those that safeguard the stand. The crop should not be pastured heavily the first year as the plants are tender and not securely established, and they will not endure grazing to any considerable extent. If well

started it may be grazed four months after seeding. Alfalfa heavily grazed may be killed and other plants will grow, especially grasses. It should not be grazed early in the spring or late in the fall. The number of hogs should be restricted so that two, or perhaps more, cuttings of hay may be secured in addition to the forage.

A plan often recommended is to divide the alfalfa into two or three fields, changing the pigs from one to the other as soon as each field has been sufficiently grazed. The objection to this method is that it requires much labor and expense in building fences and changing pigs and equipment from one field to another.

Another method recommended and considered more suitable to corn-belt conditions is to pasture continuously and cut for hay about one-third of the field every seven to ten days. This method requires no fences or changing of hogs and there is little danger of pasture shortage, as may be the case when the entire field is cut at one time. The cutting of the alfalfa should not be delayed after the new shoots have reached a length of one to two inches, as clipping the new shoots retards their later development.

Rooting by hogs on alfalfa is damaging. If this happens it may be caused by an inadequate ration. In case it is not from the ration, the pigs should be ringed immediately.

Alfalfa will not produce a good stand on acid soil, and it may be necessary to apply lime to insure best results. With the proper precautions beforehand in the selection and inoculation of the seed, preparation of the seedbed, and control of weeds, it should amply repay the investment.

Medium and mammoth red clover. Medium red clover is commonly used in the central and eastern states. It is particularly adapted to the cool, moist climate. It blooms about two weeks earlier than the mammoth variety, has a hollow stem, and often has the heads in pairs. The two species are difficult to distinguish from each other. For swine pasture the mammoth is excellent and will do about as well as the medium. Although inferior to alfalfa as pasture, clover fits into the usual farm rotation and is high in value as a swine forage. Red clover is quite



These pigs on pasture are using a straw shed shelter with an attached sunshade.

palatable except during dry periods. It has a moderately-long grazing period. Also it is a soil builder. Alfalfa by comparison furnishes a more uniform and constant supply of forage, is more resistant to drought, and endures early spring grazing.

Management of red clover pasture. Careful handling of red clover is imperative for favorable results. The pigs should not be turned into a red clover field until a growth of eight to twelve inches in height is reached. Close pasturing during the first year of its growth, or early pasturing in the spring, is likely to reduce considerably the quantity of pasture available during the season. The plants pastured close in the late fall often winter-kill. On this account it is advisable to allow a good growth to remain at this time of the year. Also the more food that is stored in the roots the more vigorous will be the growth the following spring.

Brome grass. Brome forage is seeded with alfalfa at times, to fill in where the alfalfa dies out. The combination pasture of alfalfa and Brome is not the equal of good alfalfa alone for swine.

Dwarf essex rape. Rape is one of the best forages for swine; in fact, it is ranked by many authorities as second only to alfalfa, and on a par with medium red clover. It is unexcelled as an emergency crop, provided there is ample moisture to start the seed. It is adapted to a very wide range of conditions but does best in cool climates with ample rainfall. The crop withstands drought and fairly heavy grazing. It can be ready for grazing six to eight weeks after seeding.

Like alfalfa, it balances the shortcomings of corn or similar grain admirably in the swine ration, although in most cases

a protein supplement and a mineral mixture are worth-while additions. It is seldom grown as the main crop in an established rotation but relegated to odd patches about the farmstead and areas adjoining the feed lots. It is often used as a fresh forage in the summer months and also serves well as a fall forage. However, a killing freeze usually ruins the crop for further pasturage.

Management of the rape pasture. Rape is not available for as early pasturage as alfalfa. For this reason it is often sown in mixtures, particularly with rye, oats, barley, or wheat. Pigs may be turned into rape when it is eight to twelve inches tall. As too close grazing of the plants injures the growth of the new leaves, care should be taken not to pasture too heavily. Remove the pigs when the plants have been eaten down to four or five leaves, thus allowing the plants to recuperate.

Alternating rape pastures, a practice which permits the plants to make excellent growth, is recommended. This method requires additional labor and other expense. Blistering, sun burn, or sun scald on white pigs, on pigs with very thin hair, or on pigs with white belts or spots results when the pigs run in the forage, particularly rape when it is wet and they are exposed to strong sunlight. Occasionally blistering occurs on clover or alfalfa.

Sweet clover. The biennial sweet clover is the one commonly used for swine pasture as the annual is of considerably less value. Of the biennial form, the white-flowered variety has proved superior in forage trials. It is cultivated in practically all states but is perhaps more extensively grown in the south-central and western portions of the United States. It is grown in the semi-arid region, being considered somewhat more drought-resistant than alfalfa. This crop does well on poor soils. It lacks some in palatability and often grows too rank for a hog pasture the second year. Being a legume it is a soil builder.

Management of sweet clover pasture. When sweet clover is seeded in the early spring it usually does not require special treatment the first season unless the weeds tend to crowd it out, in which case it may be necessary to cultivate. The first year's stand may be pastured from the time the plants have reached a height of six inches until late fall. Clippings should be high



Harry Fisher Farm, Minburn, Iowa

Here we see broad sows on pasture. Good pasture affords ideal conditions for the pregnant sows.

enough from the ground so the new shoots are not injured. This causes the plant to stool out more, producing a greater number of tender, palatable branches.

Close grazing should be avoided, although it may be grazed down quite close in the fall. Apparently, a tall growth is not necessary for protection during the winter, as in the case of alfalfa.

The second season's growth may be pastured the entire season. Heavy pasturing early is an advantage in curbing rank growth. Some cattle or horses may be used in the pasture to keep growth down. If it is allowed to produce seeds and is not kept down, the plants will die by midsummer.

Other clovers. Ladino clover is an excellent swine pasture because of its high protein content and desirable growth. In some trials it has been superior to alfalfa. Ladino clover has a high value for pasturing sows. Crimson clover is not adapted to a wide range of conditions, but where it can be successfully grown to produce a heavy yield, it should receive consideration in the forage-crop selection.

Alsike clover yields less than medium red clover. Its finer quality makes it preferred in some situations.

White clover is an excellent forage, but lacks in yielding ability, due to the small size of the plants. It is often used in permanent pasture mixed with grasses.

Lespedeza or Japan clover is one of the valuable forages in southern sections. It is an annual but reseeds itself, and is much used in permanent pastures when mixed with grasses such as Bermuda and bluegrass. It does not require lime in the soil.

Burr clover is used in the Gulf states and other warm climates as winter forage for livestock. It is a winter annual which reseeds itself.

Bluegrass. Bluegrass is the most widely used forage for permanent pastures. It is excellent as a source of early spring and late fall pasture, but it is often disappointing in hot, dry weather as a summer pasture. It is very hardy, makes a compact sod, and often can be relied upon as a supply of succulent feed when other crops are not far enough along for grazing. Its principal drawback is that it becomes contaminated and is, therefore, not adaptable to the clean-ground system.

This crop is at its best when making rapid growth in the early spring, as the tender bluegrass then has its highest protein content. The permanency and sureness of the crop are in its favor, and a large bluegrass pasture, if free from worms, is excellent to use as a summer range for the sow herd. Often white clover is grown in the bluegrass, which enhances the forage value of the crop. However, hogs and cattle prefer many of the other crops to bluegrass.

Timothy. It is seldom that we find timothy used as a forage for swine, but it very often is incorporated in the forage mixture and in hog-farm rotation. Timothy and clover is a very common mixture, following small-grain crops. The worth of such a mixture is dependent upon the amount of clover available, as it is preferred and is superior to timothy. In fact, timothy is one of the poorer forages, being high in fiber and low in protein.

Rape and oats. Oats is the grain generally used with rape for swine pasturage, but some prefer barley or wheat for this purpose. Rape, when seeded with grain, is used in the following approximate proportions: oats one and a half bushels, rape five to seven pounds per acre. The combination gives variety of forage and, in some cases, greater yields.

Oats and Canadian field peas and rape. This combination makes a very palatable, succulent forage for hogs. At the Wisconsin Station the combination of oats, peas, and rape has given some profit after deducting the greater expense for seed and labor. The suggested rate and method of seeding is as follows: drill a mixture of one bushel of oats and one bushel of



Here we see pigs growing and fattening on pasture. They are also provided free access to self-feeders.

field peas to an acre; broadcast five to seven pounds of Dwarf Essex rape to an acre at the same time and harrow in. This is planted in northern states at the usual oat-planting time of early spring, and it is ready for pasturing when the peas are well podded. The carrying capacity is from 20 to 23 pigs per acre, and it furnishes grazing into the fall, until the hard freezes occur, when not pastured too heavily. Canadian field peas are grown in the central or southern parts of the corn belt in the spring, but are sown in fall in the Gulf states.

Sudangrass. Experimentation has proved sudangrass to be an excellent forage for emergencies and compares quite favorably with rape and oats. However, it has a relatively short grazing period. In Kansas it was found that hogs fattening on kafir, tankage, and sudangrass pasture will be practically as well finished in a given length of time as hogs fattened on corn, tankage, and alfalfa pasture. This crop should be pastured heavily to hold it in check during the period of rapid growth, as it becomes very coarse and woody.

Rye. Usually the fall-sown rye is used as a swine pasture, as the spring-sown rye gives pasture for a limited period only and has a lesser yield, as compared with other standard forage crops. When fall sown it may be used that same fall and, in mild

winters, may be used as winter pasture. Perhaps its greatest use is as an early spring pasture, for it will furnish fresh green feed in the spring when other crops are dormant. This is an excellent early crop for sows and litters. It will not furnish pasture very long, perhaps not until it is allowed to bear a seed crop.

The value of young rye is high as swine forage. However, if the crop is allowed to grow long stems and form heads, it becomes very fibrous and lower in its worth. Green rye is laxative to young pigs under certain conditions.

Winter grains. Wheat, oats, and rye are often used for swine grazing in the southern part of the country, from the winter wheat belt southward. These crops may be fall pastured, and if not pastured too heavily or too late in the spring, a crop of grain may be produced. These pastures are especially good for sows with early-spring litters. An acre of rye pasture can save up to 100 bushels of corn and 560 pounds of protein supplement used for early litters.











Soybeans. There are several varieties of soybeans handled by seedsmen and growers in the United States. Since a great difference exists as to yield, habit of growth, length of growing season, and ability to hold leaves, suitable varieties are to be selected if used for grazing. As the seed of the soybean is more valuable than the leaves, the maturity of the seed largely determines the time of turning the pigs on the crop, which may be pastured any time from the stage when the pods are half filled until the beans are mature. When the plants are young and tender the pigs will eat practically all of the plant; but after the plants are mature, *hard and woody, they will not eat them so readily.*

The grazing and hogging-down of soybeans overlap. A further discussion of the use of the soybean is included in Chapter 15.

Cowpeas. Cowpeas belong to the leguminous family and are suited for growing on the southern border of the corn belt and farther south. They are used for hay and forage crops more than for seed. At the Iowa Station soybeans clearly excelled cowpeas as swine forage. In warm climates cowpeas produce luxuriant pasturage. Poorly fruited cowpeas grazed alone make slow and expensive gains, while well-fruited cowpeas are approximately equal to soybeans in yields per acre.

Peanuts. This crop is used to some extent for swine grazing, but it is neither so popular nor valuable as soybeans. The hogs eat the seeds, mainly.

Vetch. Vetch does not merit very serious consideration as a swine forage. It is not palatable to swine. Even in pasture combi-

CROP	GRAZING SEASON						
	April	May	June	July	Aug	Sept	Oct
Rye							
Sweet Clover (Second Year)							
Permanent Pasture (1)							
Permanent Pasture (2)							
Alfalfa-Bromegrass							
Rotation Pasture							
Alfalfa (Second Growth)							
Sudan							
Second Crop Meadow							
New Seedings							

Here is a graphical presentation of the grazing season of various pasture raised under good conditions.

nations it is practically worthless for pigs. Clover and field peas clearly excelled vetch in the Iowa trials.

Velvet beans. Pigs grazing on velvet beans alone and given no other feed do not make very rapid gains. When varieties are used that mature the seed, the crop is of value both for grazing and as a source of concentrates. Velvet beans are usually planted with corn and are grown for grazing in the late fall and early winter, when the pods are mature.

Sorghum. In the southern half of the country and in the dry-land farming regions of the western states sorghum is used as a swine forage. As a pasture for young pigs it ranks rather low because of its lack of palatability, high-fiber content, and comparatively low protein content.

Mixed pasture crops. Mixtures of forage crops are becoming more popular for swine. The mixture combines the advantages

of the crops seeded. Further a more uniform pasture is generally secured during the entire season.

A plan of pasture by months. The following plan gives the forage crops that, under usual conditions, would be available at about the 40th latitude. From this, a succession of crops may be outlined for regions southward or northward.

March—Rye, winter wheat.

April—Alfalfa, oats, bluegrass, clover, rye.

May—Oats with peas or rape, alfalfa, clover, bluegrass, rye.

June—Rape, alfalfa, clover, bluegrass.

July—Rape, alfalfa, clover, sudan.

August—Rape, alfalfa, clover.

September—Rape, bluegrass, alfalfa, clover, first-year sweet clover.

October—Rape, bluegrass, sweet clover.

November—Alfalfa, rye, winter wheat, sweet clover.

Forages adapted to the south. The following data, adapted from U. S. Department of Agriculture Farmers' Bulletin 985, gives the usual planting and grazing periods and carrying capacity of several crops grazed by hogs for the latitude of the southern coastal plain of Georgia.

TABLE 47. FORAGES ADAPTED TO THE SOUTH

CROP	USUAL PLANTING PERIOD	USUAL GRAZING PERIOD	AVERAGE LENGTH OF GRAZING PERIOD, MONTHS	AVERAGE NUMBER OF HOGS (150 POUNDS) PER ACRE	AVERAGE POUNDS OF GAIN FROM AN ACRE OF CROP
Maintenance crops.					
Oats (grain crop).....	October	Jan. 1-Mar. 1	1.9	3.5	
Oats—pasture only.....	October	Jan. 15-May 10	3.7	3.7	
Rye pasture.....	October	Jan. 15-May 1	3.5	3.8	
Rape.....	Nov. 15-Feb. 1	Jan. 15-May 15	3.2	6.3	
Bermuda grass.....		Apr. 15-Oct. 1	5.5		
Cat-tail millet.....	Mar. 15-Apr. 1	May 1-July 10	2.3	12.0	
Sorghum.....	April	June 1-Aug. 1	2.2	11.5	
Finishing crops					
Cowpeas.....	April	June 15-July 25	1.3	5.5	
Early dent corn.....	Mar. 5-Mar. 25	July 1-Aug. 15	1.6	5.5	200
Spanish peanuts.....	Mar. 15-Apr. 10	Aug. 1-Sept. 20	1.6	5.5	358
Oat stubble.....		July 1-Aug. 10	1.3		
Watermelon culls.....		June 1-July 30	2.1		
Chufas.....	April and May	Sept. 15-Dec. 1	2.1		
Sweet potatoes.....	May 5-July 5	Oct. 20-Dec. 31	2.3	12.7	
North Carolina peanuts.....	Mar. 20-Apr. 15	Sept. 15-Jan. 1	3.4	3.6	422
Velvet beans (in corn).....	April	Nov. 15-Feb. 15	2.8	3.0	



U. S. Department of Agriculture

Here we see crossbred Poland-China \times Landrace on cheat-grass pasture.

Other pasture crops. New pasture crops and more suitable varieties are being developed. Locally suitable crops are all to be considered in making a pasture program. Such crops as Birds-foot trefoil, Ladino clover, orchard grass, alta fescue, and others are possibilities. Also new information is being obtained on these and other forages and will reveal the use hog raisers may make of such crops. Ladino clover for example has been shown in one experiment to have a higher value than alfalfa for growing and fattening pigs.

Emergency pastures. When the rotation pastures fail because of winter-killing drought or other reasons, emergency pastures can be used. A combination of oats and rape will supply the early pasture, while sudangrass can be used for latter pasturage. The farm operator should consider all possible crops when making plans for emergency pastures.

General recommendations for planting and grazing crops for swine. John H. Zeller of the U. S. Department of Agriculture has summarized the recommendation for planting and grazing pasture crops for swine. The tabulation which appeared in the 1948 Yearbook of Agriculture is given in the table on page 327.

SUGGESTIONS FOR FURTHER STUDY

1. Make a list of the forage crops in your area. Determine how such crops should be grown and handled for swine grazing. Determine which are the most economical crops to grow.
2. Prepare a suitable forage crop rotation for your section.

TABLE 48. GENERAL RECOMMENDATIONS FOR PLANTING AND GRAZING PASTURE CROPS FOR SWINE

CROP	SEED PER ACRE	METHOD OF PLANTING	TIME TO SEED ¹	READY TO PASTURE	CARRYING CAPACITY PER ACRE OF 50-100 POUND STOCK
	<i>Pounds</i>			<i>Months</i>	<i>Number</i>
Bluegrass ²	6-10	In mixture	Fall.....	12-18	5-10
Alfalfa.....	15-20	Broadcast or drill..	Spring or fall ..	4-5	15-20
Red clover.....	10-13	Broadcast or drill ..	Spring or fall ..	4	10-15
Sweetclover.....	20-30	Broadcast or drill ..	Early spring ..	3-4	15-20
Ladino.....	3-4	Broadcast or drill ..	Spring or early fall	6	20-25
Rape.....	4-8	Rows or broadcast	March to June ..	1½-2	20-25
Soybeans ³	60-120	Rows or drill ..	May to July ...	1½-2	12-15
Cowpeas.....	60-180	Rows or drill ..	May to July ..	1½-2	12-15
Sudangrass ⁴	20-30	Broadcast or drill ..	May to July ..	1-1½	15-20
Rye.....	85-170	Broadcast or drill ..	Spring or fall ..	2-3	15-20
Barley.....	75-100	Broadcast or drill ..	Spring or fall ..	2-3	10-12
Wheat.....	90-120	Broadcast or drill ..	Spring or fall ..	2-3	10-15
Oats.....	65-130	Broadcast or drill ..	Spring or fall ..	2-3	10-15
Italian ryegrass ⁴	10-15	Broadcast or drill ..	Spring or fall ..	2-3	10-15
Oats and field peas.....	30 60	Broadcast or drill .. Broadcast or drill ..	March to May .. March to May ..	1½-2 1½-2	10-15 10-15
MIXED-GRAIN PASTURES					
Orchard grass.....	6-8	Broadcast or drill ..	Spring or early fall	3-6	20-25
Red clover.....	3-4	Broadcast or drill ..	Spring or early fall	5-6	20-25
Ladino clover.....	1	Broadcast or drill ..	Spring or early fall	5-6	20-25
Bromegrass.....	10	Broadcast or drill ..	Spring or early fall	5-6	20-25
Alfalfa.....	10-15	Broadcast or drill ..	Spring or early fall	5-6	20-25

¹ For information as to best pastures for locality, as well as for time and rate of seeding, consult local county agent.

² Usually sown in grass mixtures for hay. Grazed second or third year.

³ Often seeded together at rate of sudangrass 10 pounds, soybeans 1 bushel, per acre.

⁴ Frequently seeded with grain crops to give solid turf. Also furnishes succulent grazing after grain crops mature.

3. Secure publications from the state experiment station on forage crops for swine.

4. Confer with farmers in your community on the place of forage crops in swine feeding.

REFERENCES

United States Department of Agriculture:
Grass, Yearbook of Agriculture

CHAPTER 15

Harvesting Crops with Hogs

IN THIS chapter the harvesting of mature or nearly mature crops will be covered. In Chapters 10 and 14 the pasturing of crops, particularly of the forage type is covered.

Hogging-down corn. From the standpoint of acreage there is more of the corn crop harvested in this manner than any other crop. With the increased use of mechanical corn pickers there has been a decrease in hogging-down of the corn crop. In acreage the amount of corn hogged-down or entirely harvested by hogs will vary from 2 to 4 per cent. Hogs as well as other livestock provide a means of picking up corn left in the field by the picker. The amount of corn left in the field varies with the kind of corn and the season as well as the type of the picker and its adjustment. From $2\frac{1}{2}$ to 13 per cent of the corn may be missed by the pickers. With 50 bushels per acre corn the loss would be $1\frac{1}{4}$ to $6\frac{1}{2}$ bushels per acre. About 90 per cent of the corn crop in Iowa is harvested as corn grain. The remainder is hogged down, grazed, or used as forage.

Advantages of hogging-down. Following are the main advantages from the hogging-down practice: (1) It saves the labor and expense of harvesting and feeding. (2) A large part of the fertility is returned directly to the land, as the crop is fed where it is grown. (3) The practice helps to keep the hogs healthy and thrifty because of more sanitary quarters. (4) The corn stalks are in better condition for the next year's crop. (5) Less storage space is needed for the corn crop.

Disadvantages of hogging-down. Some disadvantages are found in hogging-down crops. It hardens the land, and it may be wasteful in wet weather. It also requires extra equipment and attention. It cannot be used for early spring pigs fed for an early fall market. Consequently, its greatest disadvantage is that the hogs used are finished at the time of a low-price market.

Results of hogging-down experiments. Many hogging-down tests have been run and usually the following facts are observed:

1. Hogging-down corn when properly managed may result in more economical gains than feeding husked corn, regardless of the supplementation.

2. The hogging-down of straight standing corn under most conditions proves unprofitable.

3. Soybeans in the hogged-down corn, even though used with minerals, seldom produce as much gain per acre as hogging-down corn plus tankage. The feeding of a protein concentrate will increase the gains and under most conditions will be economical. From 0.3 to 0.4 of such a supplement is needed per pig daily.

Soybeans in the standing corn will not eliminate the need for a protein supplement. Soybeans planted with the corn is preferable to seeding rape at the last cultivation.

Varieties of corn to use. Early-maturing corn is preferable for hogging-down. With early corn, less last-year's corn need be used for the pigs, and in the early fall there is usually less rainfall. The feeder should use varieties that are adapted to local conditions, because the value per acre is determined by the yield of fairly mature corn. A variety not using the full growing season fails to produce as much corn yield as standard time-tried varieties.

Time to hog-down corn. Hogs may be turned into the fields of standing corn any time after the dough stage. Greater acre yields in swine gains are made when the corn is fairly mature. Many do not turn hogs into the field until the kernels are well dented and quite mature. In the maturing period a great increase in the dry matter content of the corn is shown. Immature

corn is as high in nutritive value based upon the dry matter, but the dry matter may be considerably less per acre. The change in feed should be gradual, as new corn may cause digestive disturbances and may lower resistance to swine diseases. The hogs may be turned in for a part of the day for a time at first until they become accustomed to the new corn.

Portable fences. It is usually recommended that the hogs be turned into only a limited area at a time, allowing field space enough to keep them for two weeks. The entire hogging-down period is usually less than 60 days. A temporary fence of 26- to 32-inch woven wire attached to the posts on both sides of the field, plus a few anchor posts, and tied to the corn stalks will suffice while the corn supply is ample. If good weather prevails there is little to be gained by restricting the area allowed.

Hogs per acre of corn. The yields of corn per acre and the size of the pigs influence the length of time needed for a drove of hogs to clean up a given area of corn.

The addition of a supplemental feed increases the amount of corn consumed; ten pigs between the weights of 75 to 100 pounds will consume about one bushel of corn daily when fed a supplement with the standing corn. The table given below is from the Purdue Station, Circular 102.

TABLE 49. NUMBER OF 125-POUND HOGS REQUIRED PER ACRE FOR HOGGING-DOWN CORN

YIELD BUSHEL OF CORN, PER ACRE	15 DAYS, NUMBER HOGS	20 DAYS, NUMBER HOGS	25 DAYS, NUMBER HOGS	30 DAYS, NUMBER HOGS
30	18	13	10	9
40	24	18	14	12
50	30	23	18	15
60	36	28	22	18
70	42	33	26	21

Hogs to use for hogging-down. Purdue Circular 102 includes the tabulated (page 331) data on the gains made and feeds consumed by hogs of various sizes.

The lighter-weight pigs made slower daily gains, required less corn for a pound of gain, and gained more per acre of corn.

TABLE 50. GAINS MADE AND FEEDS CONSUMED BY HOGS OF VARIOUS SIZES

AVERAGE INITIAL WEIGHT	AVERAGE FINAL WEIGHT PER HEAD	DAILY GAIN AVERAGE, POUNDS	CORN PER POUND GAIN	PER ACRE POUNDS GAIN
60 to 70	160 to 175	1.75	4.74	676
75 to 90	175 to 200	1.87	4.91	631
90 to 110	190 to 210	1.96	5.02	593
110 to 130	210 to 230	2.11	5.34	521

Lighter shoates usually require more tankage or other supplement for a given gain in weight.

Active hogs which are rather thin and of good feeder type are preferred for hogging-down corn. Hogs weighing about 100 pounds fed limited rations on pasture will make a creditable showing in hogging-down corn. Very fat hogs do not glean the corn with as little waste as thin hogs. If fat hogs are used, the field should be gleaned afterward with thin, active hogs. Small pigs are not suited for hogging-down, and, if they are to be used, larger hogs should be included as well to knock down the corn. Growing gilts should not be put in the hogging-down lot for any length of time as they may become too fat for breeding. The sow herd, particularly yearling and older sows, may be used for cleaning up the cornfield after the fattening hogs have been removed.

Other crops with corn for hogging-down. Many crops are used with the corn crop for hogging-down. The soybean crop is a common supplement used in the corn belt. The soybeans are planted with the corn crop. As corn furnishes but little forage for hogs, a supplemental forage is usually advantageous. Rape is another crop often used in hogged-down corn and has been found an economical supplemental forage. It is usually planted after the last corn cultivation. Rye and sweet clover also are used in the same way.

Supplementing the standing corn. Hogging-down corn alone is not so efficient as when supplemented with other feeds. This may be accomplished in several ways. (1) A protein-rich crop like soybeans or cowpeas may be grown with the corn. However,



These pigs are hogging-down corn. If properly conducted and conditions are good, hogging-down corn is profitable.

this usually does not serve as a complete replacement for a protein and mineral supplement. (2) Green forage, such as alfalfa, sweet clover, rye, or rape, is supplied in a separate field or, in some cases, is seeded with the corn. A protein and mineral supplement is also advisable. (3) Protein-rich supplements and mineral supplements are fed in addition to the standing corn.

Per acre yields of corn with soybeans. The planting of soybeans with the corn reduces the corn yields. This is replaced by a yield of soybeans. The effect upon the corn crop depends upon the method of planting. Checked corn with soybeans almost always showing a reduction in total yields; whereas soybeans in drilled corn often increase the total yield in pounds per acre. Growers can expect about four bushels of soybeans per acre in checked corn and about seven bushels in drilled corn. The effect of the method of planting is shown by the table below, which gives averages compiled by Robison of the Ohio Station for trials covering a period of several years at five stations. The

TABLE 51. INFLUENCE OF SOYBEANS IN CORN ON YIELDS SECURED

HOW PLANTED	YIELD PER ACRE					REDUCTION IN THE YIELD OF CORN	LOSS OR GAIN IN TOTAL YIELDS, POUNDS
	Corn only		Corn containing soybeans				
	Bushel	Pounds	Corn, bushel	Soybeans, bushel	Both pounds		
Average in checked corn	47.7	2,670	40.5	4.3	2,528	7.2	-142
Average in drilled corn	54.6	3,057	47.9	6.9	3,095	6.7	+38

use of soybeans in the corn is not attended with the most favorable results unless a protein supplement and a mineral supplement are allowed. The lighter-colored soybeans are preferred

because fewer are likely to be lost, as the pigs can see them more plainly. Lighter-colored soybeans are also thought to be of higher palatability.

Corn and soybeans are not always advantageous. Five-year trials comparing corn versus corn and soybeans with tankage, or no protein supplement, at the Missouri Station have not shown very favorable results for the inclusion of soybeans. In fact, 100 pounds of tankage was as valuable as 400 pounds of soybeans. Following is a summary of the findings:

1. Hogs harvesting corn and soybeans produced more pork per acre, made more rapid gains, and required less feed per 100 pounds gain than did hogs harvesting corn alone.

2. More pork was produced per acre, gains were more rapid, and less feed was required per 100-pounds gain with corn and tankage than with corn and soybeans.

3. The corn and tankage combination produced more pork per acre, made more rapid gains with a smaller feed requirement per 100-pounds increase in live weight than did the combination of corn, soybeans, and tankage, indicating that soybeans will not entirely take the place of tankage if planted in corn to be hogged-off.

Grazing soybeans alone. This is usually not so successful a practice in most sections as the corn-and-soybean combination because of the lower acre yields. The grazing period is also considerably less when soybeans alone are used. Under unfavorable hogging-down conditions many of the soybeans are lost. Feeding on soybeans alone produces soft pork.

Grain sorghum for hogging-down. Kafir is less valuable than corn for hogging-down. Pigs make slower gains on the kafir and require more feed for a unit of gain. A test at the Nebraska Experiment Station on several varieties of sorghums (Day milo, sooner milo, and early kalo) indicate that 435 pounds of hogs gain could be attributed to one acre when a good ration was fed.

Hogging-down grain crops. Early maturing grain crops such as rye and barley may be harvested by hogs. This is seldom a profitable method of harvesting. In fact, in most cases harvesting

and marketing are more profitable than hogging-down. In dry areas nearly ripe grain crops are sometimes hogged-down.

Hogging-off field peas. In northern sections of this country where field peas are profitably grown, the crop may be hogged-off. The hogs are turned in when the pods are well formed and the seed begins to harden. No other feed but a mineral mixture is necessary, since the peas have a high protein content. It is advisable to remove the fattening hogs before the entire crop has been hogged-off, and then to use some thin hogs to glean the field of peas. The following table from Bulletin 198 of the Washington Station summarizes their three-years' work with hogging-off of field peas.

TABLE 52. POUNDS PORK PRODUCED PER ACRE
OF PEAS

	THREE-YEAR AVERAGE
Yield of peas in bushels	23½
Pork per acre in pounds	181.5
Days one acre supported 10 pigs	18.6

Pigs gain more rapidly on corn being hogged-down than on field peas.

The Jerusalem artichoke is used occasionally for harvesting with hogs. The tubers are relished by the hogs, but the amount of pork produced per acre is less than in the case of corn.

Harvesting other root crops with hogs. In the South, there are several root crops which may be harvested with hogs. Included in this group are sweet potatoes, chufas, and cassava. For fall and early-winter grazing in the South, the sweet potato is the best root crop. A fertile, well-drained, sandy loam soil will in certain sections produce as much or more feed for pigs when planted to sweet potatoes than when planted to corn. A sandy loam soil will produce ten bushels of sweet potatoes to one bushel of corn. Usually, however, sweet potatoes cannot be harvested and stored and then fed to hogs profitably. A limited grain ration, a supplemental feed, and a mineral mixture are

necessary with the sweet potatoes for good gains on growing and fattening pigs.

Chufas are somewhat like artichokes but are of smaller size. Experiments at the Georgia Station indicated that one acre of chufas produced 307 pounds of gain of hogs that were allowed corn and cowpea meal in addition.

Cassava may be used for swine grazing and harvesting, but usually produces less hog gains per acre than other crops.

Pumpkins and squashes. These are sometimes used in swine feeding. They may be planted in the cornfield at the time of the last cultivation and hogged-off, or they may be grown separately and fed in dry-lot. They are considered by some as being beneficial in the removal of intestinal worms. As the crop lasts but a short time in the fall and early winter, the length of time for feeding is rather short. Pigs make very slow gains when fed these alone; under most conditions the most economical method of utilization is with a ration of concentrates.

Equipment for hogs during field feeding. With the hogs pasturing in a large field, it becomes necessary to have ample equipment near at hand, movable houses for shelter, a self-feeder for minerals and protein supplement, and a hog waterer in order that there may be a constant supply of fresh, clean water.

SUGGESTIONS FOR FURTHER STUDY

1. Determine the extent of harvesting crops with hogs. When and how should crops be harvested with hogs?
2. Make a study of a farm, and make a plan for harvesting corn with hogs.

REFERENCES

- MORRISON, F. B. *Feeds and Feeding*. The Morrison Publishing Co., Ithaca, New York
- SMITH, W. W. *Pork Production*. The Macmillan Co., New York

CHAPTER 16

Swine Breeding

THERE ARE many breeding problems which confront the swine producers, both the purebred breeder and the market-hog raiser. A herd may be improved by the introduction of better feeding methods, or the producer may improve through the use of better animals. The characteristics which hogs have today are the results of the evolution which has taken place since their domestication. Growers continue to make hogs better through improvement in breeding and feeding methods.

Breeding terms. There are several terms used with regard to animal breeding which perhaps should be cleared up before proceeding with the discussion. Some of the more common terms are included in the remainder of the chapter.

1. *The breeder* is regarded as the owner of the dam at the time of mating.

2. *Inbreeding* is the mating of closely related individuals, and generally includes such matings as brother and sister, sire and daughter, and son and dam. It may be used to bring about the fixation of characteristics.

3. *Line breeding* is the mating of related but not closely related individuals; for example, the mating of second cousins. It is a mild form of inbreeding.

4. *Out-crossing* is the mating of animals that are not closely related to one another.

5. *Back crossing* is the mating of a cross-bred to one of the

parent breeds, such as the crossing of a crossbred Poland-China Duroc gilt to either a Poland-China or Duroc boar.

6. *Crisscrossing* is the continuous back crossing alternating of the breed used. For example in the case given under backing if a Poland-China boar is used for the back cross, a Duroc boar will be used on the back-cross gilts.

7. *Cross lines or in-cross*. This refers to the mating of individuals from different inbred lines.

8. *Hybrid or hibred hogs*. Used by some to refer to crosses from various inbred lines.

9. *Prepotency* is the ability to transmit characteristics to the offspring to a marked degree.

10. *Nicking* is the term applied when the offspring is better than the conformation of the sire and dam seem to justify. Animals may also react oppositely; that is, fail to nick well.

11. *Family* is a group of animals rather closely related to each other, and they may be distinctive in some of their characteristics.

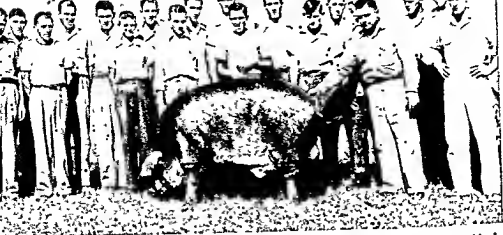
12. *Line of breeding* is a group of animals descended from some animal—usually the descendants of some noted boar, as the Sensations in the Duroc breed.

13. *Acquired characters* are changes in the structure or function of an animal brought about during the life of the animal and not inherited from the parents.

14. *Mendel's law* is composed of two fundamental principles of heredity: the law of segregation and the law of independent assortment. Mendel noted that the factors or genes for inherited characters separate from one another and form new combinations in the germ cell in accordance with the rule of chance.

15. *Galton's law* is the statement of the inheritance which an animal receives from various generations of its ancestry. The first generation, or the sire and dam, contributes 50 per cent, the second 25 per cent, the third $12\frac{1}{2}$ per cent, the fourth $6\frac{1}{4}$ per cent, and so on.

A purebred. An animal which is registered or eligible to registry in the record book of its breed is regarded as purebred. Purebreds have definitely established characteristics and trace



This is a purebred Duroc boar, an Iowa State Fair grand champion. He is owned by the Iowa Falls Duroc Association, a part of the vocational agricultural program.

to the foundation animals of the breed. A scrub, on the other hand, is of nondescript breeding and of no definite type. There are not very many scrubs in the large hog-growing areas, most of them being in the remote sections; yet but 0.6 per cent of our hogs are registered purebred and about 1.0 per cent of the farms have registered purebreds.

The advantages of the purebred. It must be realized that not all purebreds are of high merit. In fact, there are purebreds which are very inferior and unworthy of perpetuation. However, the purebred excels the scrub in the following respects:

1. Greater size or weight for age.
2. Finished for the market at an earlier age.
3. More efficient conversion of feed into grains.
4. Increased quality and value of the meat produced.
5. The sows excel in prolificacy and suckling ability.

The scrub and the pure-bred compared. The European wild boar is the progenitor of the domesticated hog of our country. In the process of development the blood of the Oriental hog (from the Indian wild hog) was used. The hog of today is the result of improvement made possible by selection coupled with better methods of feeding and breeding. A comparison of the wild hog with the domestic would show the results of these methods, as well as the relative efficiency. In reality it would be a comparison of the scrub with good breeding. Such a trial at the Iowa Station yielded the following facts and observations:

A Poland-China litter returned the greatest daily gain, made the 200-pound average weight in the least number of days, and required the least feed for 100-pounds gain. This litter required only 210 days from weaning time to the 200-pound average weight as contrasted with 238 days in the case of a half "wild" litter, and 295 days in the case of a three-quarters "wild" litter; here is a timesaving of 28 to 85 days, respectively.

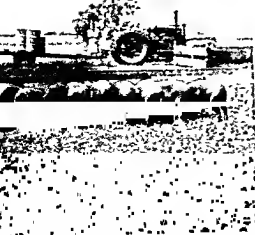
More total feed was required for the 100-pounds gain in the case of the Poland-China litter and the half "wild" litter in going from weaning time to 200 pounds, and less total feed was needed for the three-quarters "wild" litter in going from weaning time to the 150-pound average weight.

The total amount of feed required for the 100-pounds gain, weaning time to 200 pounds, was 417 for the very high-grade Poland-China litter, 491 pounds for the half "wild" or "scrub" litter, and 643 pounds for the three-quarters "wild" or "scrub" litter.

The Poland-China litter made 100-pounds gain at a feed cost of \$6.88, or \$3.82 less than the three-quarters "wild" litter, the most costly of the two "scrub" litters.

The measurements showed quite clearly that the "scrub" or "wild" pigs were large for their age, but they lacked markedly in compactness and depth of flesh. The crosses of the wild boar resulted, therefore, in producing very rangy pigs, length of body, high at the shoulder, big of middle, large of chest, and long of leg. These "wild" crosses were light in the ham, and showed a thin covering of flesh with a marked absence of the customary fat back development.

The scrub boar's costly influence. The scrub boar produced inferior offspring which during the growing and fattening period showed marked inefficiency as pork producers. The scrub boar in one cross, the first on the Poland-China sow, produced pigs that took 148 pounds more of feed to make a 200-pound hog than was the case of the pigs resulting from the same sow and a purebred Poland-China boar of medium to big type. Had this scrub boar covered 30 sows and produced 180 market pigs (which is too liberal an estimate), the loss in feed requirements alone in the production of the pork weight would have



These are purebred Duroc gilts owned by a member of the Iowa Falls Duroc Association.

amounted to over 13 tons of feed, which at \$40 a ton would have cost extra over \$520.

The more sows that such a boar covers, the greater the loss. Such a boar likewise produces a type of hog for market that is discriminated against in markets at selling time, hence the greater the losses.

The razorback. A retrograde of the domestic hogs is the razorback which formerly was fairly common in the southern part of the country. At the Arkansas Station a razorback sow that had attained the weight of 60 pounds when 18 months old was mated with a purebred Poland-China boar. The resulting pigs weighed on the average 170 pounds at 6 months of age, nearly three times the weight of the dam at 18 months.

TABLE 53. COMMENTS BY FARMERS SHOWING POINTS IN WHICH PUREBRED ANIMALS SURPASS COMMON STOCK

CHIEF POINTS OF SUPERIORITY	PERCENTAGE OF FARMERS' COMMENTS
Better conformation and quality	14.6
Better selling price of animals	12.8
Increased production	12.1
Stock more salable	11.9
More product for the feed	9.2
Owner's interest and pride, giving better care and returns	9.2
Uniformity (factor in making sales)	8.9
Early maturity	7.8
Ease of fattening and finishing	5.7
Better prices for products	3.0
Increased vigor	2.7
Dolility and ease of handling	2.1

It is quite evident that producers appreciate the many points of superiority of purebreds over common stock.

The grade. An individual that has one of the parents purebred is termed a grade. The other parent is a grade or scrub. The one purebred is usually the male.

Grading-up. The process of herd improvement by the introduction of purebred sires is known as grading-up. Through use of successive purebred sires the amount of purebred blood increases rapidly. Fifty per cent of purebred breeding is accomplished by the first generation, 75 per cent by the second, 87½ per cent the third, and so on. It is quite apparent that through the use of purebred boars, the herd will be high grade very soon. This is the best and

cheapest method for common herd improvement. Through the yearly selection of the best of the gilts for breeding and the mating of these with a purebred boar, the scrub or grade is reduced to an amount of no consequence. These are called high-grades, and are equal in most particulars to purebreds. A grade boar should not be used for breeding because in ancestry he represents 50 per cent of the crop of pigs. Money saved by buying a grade boar is usually lost in the pigs produced. The purebred breeding which the grade carries is responsible for his goodness. This overshadows the inferior which he carries that would be passed on if he is allowed to reproduce.

The Alabama experiment on grading-up is an excellent example of what can be done by this method of breeding. The essential information is included in the table on page 342.

Poland-China and Duroc boars were used as sires. The feed for 100-pound gain was for the period, 56 days of age to the



A sow and litter will make a worthwhile project for F.F.A. and 4-H Club members.



These are crossbred Duroc Poland-China hogs. Crossbred pigs may make fast and economical gains.

TABLE 54. WEANING WEIGHT AND FEED FOR GAIN BY SCRUBS AND GRADES
(Alabama Agricultural Experiment Station)

BREEDING	SCRUB, POUNDS	1ST GRADE, POUNDS	2ND GRADE, POUNDS	3RD GRADE, POUNDS
Weaning weight.....	22	29	28	35
Feed for 100 pounds.....	507	445	408	412
Gain per cent of purebreeding..	0	50	75	87½

weight of 200 pounds. It will be noted that the amount of improvement becomes less as grading-up is continued.

It has been estimated that it took 448 pounds of concentrates to produce 100 pounds live-weight gain on pigs for 1938 to 1940. If ten pounds of feed could be saved in putting on that gain, 20-million bushels of corn would be saved on an average spring pig crop.

The crossbred. The offspring of the mating of a purebred of one breed with a purebred of another breed is known as a crossbred. Crossbreds are quite common in swine and under certain conditions may be advantageous.

Hybrid vigor. This is also termed heterosis and is commonly called crossbred vigor. It is the increased growth and vigor often shown by crossbreds. This is apparently not manifest in all crosses.

The advantages of the crossbred. Crosses of certain breeds impart to the offspring added stimulation of growth and vigor.

This is illustrated by trials at the Iowa Station reported in Bulletin 380, *Crossbreeding for Pork Production*.

The following statements concern the average results. There was much individual variability from litter to litter and from pig to pig even in the same litter, both among crossbreds and among purebreds.

The results obtained at the Iowa Agricultural Experiment Station involve 1,015 pigs farrowed in 180 litters. These data include the Landrace \times Poland-China crosses as well as those made with the Duroc Jersey, Poland-China, and Yorkshire breeds.

The percentage of stillborn pigs was smaller among the crossbreds as shown by their ability to survive until weaning age.

Crossbred pigs averaged about three or four pounds heavier at weaning time than purebreds. The weaning weight of crossbred litters averaged more than for comparable purebred litters, partly because of the larger size of the pigs in the crossbred litters and partly because the crossbred litters on the average contained slightly more pigs at weaning time.

Crossbred pigs gained about .09 to .12 pounds more per day while in the feed lot than purebreds, which means a saving of about ten days to two weeks time in getting them to a weight of 225 pounds.

Crossbreds reached a weight of 225 pounds on 25 to 30 pounds less feed than was required by purebreds.

The crossbred sows observed in this study proved to be efficient pig producers, either when mated back to a boar of one of the parent breeds or to a boar of a third breed. When sired by a purebred boar the pigs from the crossbred sows, either backcross or three-breed cross, compared favorably with the first-cross pigs.

There is some general reason to suppose that breeds differ in their response to crossing and also that families or strains within breeds differ, but not enough evidence to determine which breeds can be expected to cross best with each other, nor whether distinct families which cross better than others exist and can be identified and maintained within pure breeds.

Crossbreeding can be continued as a steady policy only by

going to purebred herds for the boars needed for replacement. Crossbred animals have a lower value than purebreds as transmitters of inheritance. Crossbred sows may be used successfully for breeding if the boar is a purebred. In this way the hybrid vigor of the crossbred dam in nursing and rearing pigs may express itself enough to more than compensate for her lower value as a transmitter of inheritance. No such offset for his lowered transmitting value could exist in the case of a crossbred boar. Planless and unsystematic crossing may quickly result in a mongrel herd from which the owner will get neither profit nor pride of ownership.

Crossbred sows. The question as to the keeping of crossbred sows for raising pigs frequently is raised. There are two methods open for those who keep the crossbred gilts. They may be bred back to one of the parent breeds (back crossing) or a sire of another breed may be used (the three-way cross). The crossbred gilts have in instances proven satisfactory as brood sows. The vigor gained from the cross has been responsible for larger and stronger litters and greater milk yield when vigor has been gained from the first cross. In other words, when the crossbreds are better than the straight breeds the gilts, if well selected, may be good producers.

Crisscrossing starts with back crossing and involves retaining the crossbred gilts in each generation and alternating the back cross to the two different parent breeds involved. In experiments at the Minnesota Experiment Station crossbreds, three-breed crosses, and back crosses were found to be superior to purebreds from which the cross came. The crossbred sows in these trials had litters two-thirds to two pigs larger. The pigs weighed five to seven pounds more at weaning time, and the weaned litters weighed 63 to 67 pounds more than the purebreds. The crossbred were finished for market (220 pounds) 17 to 22 days sooner with from 27 to 36 fewer pounds of gain.

Crossbred boars. Under most conditions it is inadvisable to save crossbred boars for sires. The offspring from such a sire, when used on crossbred sows, would lack in uniformity of conformation and performance. The use of a purebred sire would give more uniform pigs and would give uniformity to the breed.

in all respects. Further, that is expecting the impossible because the hog raiser couldn't expect to get the best of two breeds in any crop of pigs. He must choose one breed, or use a cross. While the advantage may be slight, for market hog production the crosses are generally superior.

Inbreeding. There is a loss of vitality with inbreeding. The litter size and weaning weight decreases with an increase in the inbreeding. Inbred boars are generally less active sexually than noninbred boars. Consequently inbred boars do not show up well in commercial hog production. There appears to be some advantages at times from the use of cross-line inbreds. Crossing of inbred lines within and between breeds is being tested. Some tests have appeared favorable. Further investigations will reveal how commercial hog raisers can make use of such stock.

Color inheritance. As crossbreds are quite common in swine it is interesting to note the results of crossing on the color of the offspring. The wild-hog progenitor of the domestic hog is greyish black in color and usually has a banding pattern on each hair. The oriental hogs used with the wild hog in forming our domestic hogs are rather mixed in color. In our hogs today we have three base colors: white, red, and black. Also we have color patterns, for example, spotting, belting, and white points or markings.

These colors do not all behave the same on crossing. For example, Hampshire black is more intense than Poland-China black. There are at least three kinds of black in swine as regards inheritance. Here are some of the crosses and the usual color of the offspring.

Poland-China or Berkshire \times Duroc or Tamworth gives red and sandy color with black spots.

Mule Foot (self-black) \times Duroc gives Black.

Poland-China or Berkshire \times Chester White or Yorkshire gives white with black spots in the skin.

Duroc or Tamworth \times Chester White or Yorkshire gives white with some red hair.

Hampshire \times Duroc or Poland-China gives mostly black with white belts.

Hampshire \times Chester White gives mostly white with black spots in the skin and some black hairs or roaning.

INHERITANCE OF DEFECTS

There are many hereditary defects which appear in swine that have been reported upon and the method of inheritance studied in some cases. It should be pointed out that the development of any character in an animal is dependent upon the hereditary genes, their interaction and also the environment. Hereditary and environment vary in their effects on different characters. Characters which appear under a wide range of environment are, of course, highly hereditary.

Some of the defects noted in hogs are listed below:

Swirls or whorls. These appear along the top line and are objected to in purebreds although the presence of the swirl does not influence the value of market hogs. Swirls in the flanks are disregarded in selecting purebreds. Two dominant complementary factors are responsible for the occurrence of this condition. One out of six possible combinations of these will give a swirl and only the one combination will be pure from the lack of swirls. Four out of the six combinations will carry the character without it appearing. Therefore, boars and sows from litters in which there are no pigs with swirls should be used for breeding.

Inverted teats. Inverted teats are commonly called blind or button teats and commonly occur on the third and fourth pair from the front in some of the breeds. In some cases it is difficult to determine for certain whether or not the teats on a young gilt are normal as questionable teats sometimes function normally upon suckling. As this defect is hereditary and can become quite prevalent in the herd sows with imperfect teats or boars producing such sows are to be discarded from the breeding herd.

Screw or kinky tail. Screw tail is a short tail which is turned and not as flexible as a normal tail. The vertebrae in the tail are fused together. It is a recessive character and is of little economic consideration. It is objected to by some purebred breeders.

Cryptorchid or ridgling or one seeded. In this condition but one testicle has descended into the scrotum. Double cryptorchids have been observed, that is, those in which both of the testicles

are retained in the abdominal cavity. The testicles in the body cavity are infertile. This character is thought to be a simple recessive and breeding stock used should be selected from litters in which the condition has not appeared.

Hernia. Of these there are two common kinds, scrotal or inguinal hernia and umbilical or navel hernia. In the former a loop of the bowel descends into the inguinal canal into the scrotum. In successful castration of pigs so herniated a skilled operator is essential. The other type of hernia is at the navel and a loop of the bowel is through a part of the abdominal wall. Apparently scrotal hernia is due to the presence of two pairs of recessive factors in homozygous conditions. Breeding stock producing pigs with hernia are to be discarded.

Other hereditary defects. Many other defects have been noted in swine which have in part a hereditary basis. Included in this list are defective skulls, abnormal ears, tumors, extra toes, syndactyly or mule foot, wooly hair, hairlessness, and cleft palate. Various types of paralysis and sterility have been attributed to heredity.

What causes runts? The following data obtained by the U. S. Department of Agriculture from 783 farmers showed the principal causes of runts:

CAUSES	PERCENTAGE
Inferior breeding	31.6
Inadequate or unsuitable feed	30.4
Parasites and insect pests	15.1
Lack of adequate housing and care	12.4
Contagious diseases	4.9
Exposure	2.9
Accident	1.0
Other causes	1.7
Total	100.0

The "other causes" included inbreeding, breeding immature animals, excessively large litters, poor condition of dam, overcrowding at feed, digestive troubles, lack of exercise, weaning too early, unkindness, and a variety of minor causes.

Because of the great prolificacy, swine improvement can be

effected in a short period of time. When breeders recall that a sow may farrow two litters of at least seven pigs in a year and a boar may settle 20 to 40 sows in a breeding season, there seems to be but little excuse for the 31.6 per cent runts caused by inferior breeding.

Ways to prevent runts. Opinions obtained by the same survey on the best methods of preventing runts appear below; the list represents, in a sense, methods of overcoming the principal causes of runts already given:

METHODS	PERCENTAGE
Proper and adequate feed	31.9
Better breeding	24.3
Good care and systematic attention	18.3
Better housing and sanitation	9.4
Care of dam before birth of young	5.7
Control of parasites (worms, lice, etc.)	3.5
Control of disease	1.2
Other methods	5.7
Total	100.0

It is noticeable that whereas inferior breeding occupies first position as the chief cause of runty livestock, proper and adequate feed is given first as a preventive method. Breed and feed make the animal every time.

Selecting the sire. Grade boars should not be used. The boar, or sire, is one-half of the herd. Consequently, because of his individual influence in reproduction, his selection should be with the greatest of care. One sow may raise seven pigs, and because of the inferiority of the pigs she may be discarded. A boar may be mated with 30 sows and because of his inferiority, the whole crop, say of 210 pigs, may be detracted from in value. The sire to be selected merits the most careful consideration. The most reliable index to a boar's ability to produce superior offspring is the progeny test. This is less applicable in swine than other classes of livestock because of the lack of definite records and the short span of the breeding period. In the absence of the progeny test or the establishment of the boar as a "proved sire" the conformation and pedigree are to be used as indexes. Performance

records, when available, are also to be used in making a selection.

Conformation as a basis for selection. "Like begets like" is a common adage. The offspring of the best individuals are usually of excellent conformation. However, this does not always hold and the breeder should not rest his decision upon the matter of individuality alone. The size for age, general conformation, or type conformance to breed ideals, sex character, constitution, and vigor are all of prominence in selecting the breeding boar. There is no definite assurance that these will be transferred consistently to the offspring.

Pedigree as a basis for selection. The matter of conformation should be balanced with pedigree, or the animal's ancestry in making a herd-sire selection. The presence or absence of excellent animals in the pedigree may be taken as an index to the animal's ability to reproduce the better kind. Yet a prominent animal, say in the third or fourth generation, exerts no great influence upon the present generation. All of the individuals in the animal's ancestry contribute to individuality. The influence of a meritorious animal in the ancestry may be overshadowed by an inferior animal. Yet the average of the ancestry of an individual will forecast the progeny of that same individual.

Methods used to improve purebred herds. The breeder is continually striving to better his herd. Various methods are at his command to accomplish this purpose. The U. S. Department of Agriculture found that comments from many livestock breeders indicated the following distribution of methods used:

METHOD	PERCENTAGE
Use of superior purebred sires	36.4
Selection and care in mating	28.0
Use of superior females	9.3
Culling of less desirable animals	7.1
Better feeding	5.4
Better care	5.4
Testing for production	3.5
Line breeding	2.7
Study of literature and records	2.2
Total	100.0

Swine record associations. The purposes of the record associations are to record the pedigrees, publish herdbooks, encourage shows and fairs by futurity shows and special premiums, and advertise the breed. Some records also provide field service, promote sales, and publish a breed paper. Following is a list of the swine record associations:

BREED REPRESENTED	ASSOCIATIONS AND ADDRESS
Berkshire.....	American Berkshire Association, Springfield, Illinois
Chester White.....	Chester White Swine Record Association, Rochester, Indiana
Duroc.....	United Duroc Record Association, Peoria, Illinois
Hampshire.....	Hampshire Swine Registry, Peoria, Illinois
Hereford.....	National Hereford Hog Record Association, Chariton, Iowa
Inbreds.....	Inbred Livestock Registry Association, University Farm, St. Paul, Minnesota
Kentucky Red Berkshire.....	Kentucky Red Berkshire Swine Association, Lancaster, Kentucky
Landrace.....	The American Landrace Association, Noblesville, Indiana
OIC.....	OIC Swine Breeders' Association, Goshen, Indiana
Poland-China.....	The Poland-China Record Association, Galesburg, Illinois
Spotted Poland-China.....	National Spotted Poland-China Record, Bainbridge, Indiana
Tamworth.....	Tamworth Swine Record Association, Hagerstown, Indiana
Yorkshire.....	American Yorkshire Club, Lafayette, Indiana

These associations record pedigrees for members or nonmembers, but the fees are higher for nonmembers.

Recording purebreds. Each student should write the record associations or the associations of the breed in which he is interested to secure forms for recording and transferring purebreds and literature concerning the breed. The requirements for registration are different for the various breeds. The rules for registration for the breed interested in should be studied.

The pedigree includes the name and registration number and sex of the animal, the volume of the herdbook in which it is recorded, the date of farrow, size of litter, and number of boars and sows raised from the same litter. There is also included the name and address of the breeder and the transfers of ownership. The ancestry is extended back two or three generations on most swine pedigrees. The pedigrees in the various record associations vary some in the details given and form presented, but generally include the above information. In some transfers of purebred swine the application of registration is given to the buyer by the breeder. This form, filled out and signed by the breeder, contains the data necessary for registration and for making application for a pedigree from a record association.

STANDARD PUREBRED SWINE GUARANTEES

When purebred swine are offered for sale as breeding stock they are commonly guaranteed to be breeders by the seller. At the same time, it is further recognized that care and treatment of the animals subsequent to the date of sale may, after a reasonable length of time, affect the animal's reproductive ability, and therefore, any guarantee must be confined to a reasonable time limit. There have been certain suggestions made by the National Association of Swine Records for use in purebred swine transactions at private treaty or in public auction:

General sales provisions. (1) It is understood, unless otherwise specifically stated in writing, that all breeding stock offered for sale has been double-treated against hog cholera.

(2) A certificate of registration properly transferred to the records of a recognized record association for the breed shall be delivered to the new owner free with animal represented as being purebred; unless the purchaser releases the seller from this provision in writing.

(3) In all adjustments the seller, to avoid unnecessary expense, may direct the open marketing of any animal he accepts as being a nonbreeder, accepting the sale price as shown by the commission firm's sales ticket and the return of the certificate of registration instead of the return of the animal in question.

(4) In case of any adjustments, all transportation charges shall be divided equally between buyer and seller.

(5) No charge for feed and maintenance shall be made by either buyer or seller.

Boars. (1) All boars over five months of age are guaranteed breeders except when let run with sows.

(2) Requests for adjustments must be made within 60 days.

(3) The seller reserves the right of a trial period of ten days for any boar which fails to settle sows; at which time seller shall make replacement satisfactory to buyer, or refund purchase price of any boar proven to be a nonbreeder, provided he is returned to seller's farm in healthy condition and satisfactory state of flesh.

Open sows. (1) All open sows five months of age or over are guaranteed to be open and to be breeders.

(2) The seller shall make replacement satisfactory to buyer or refund purchase price of any open sow which proves to be with pig at time of sale, or which fails to come in heat, or which fails to settle on second service, provided she is returned to seller's farm in healthy condition and satisfactory state of flesh.

(3) The seller shall have the right to defer adjustment on any open sow for 30 days pending evidence that she is not with pig, and is a nonbreeder. Should she prove to be safely settled, she shall be returned to purchaser at purchaser's expense.

Bred sows. (1) All bred sows are guaranteed to be with pig to the indicated boar and date of service.

(2) Claims for adjustment must be made no later than three calendar months after the indicated service date.

(3) No guarantee is made as to the number and quality of pigs bred sows will farrow and raise.

(4) Farrowing dates shall be calculated at 115 days, but farrowing may vary as much as nine days either way.

(5) The seller shall refund one-half the difference between the purchase price and market value of the sow as of date of sale on any sow which fails to farrow within the above specified limits—except sows which lose their litter due to injury or disease.

(6) After this adjustment, the sow then takes the status of an

open sow, and in addition, the guarantee for open sows shall apply on any sow which proves to be a nonbreeder.

(7) In lieu of the above adjustments, upon agreement of both buyer and seller a sow which fails to farrow within the specified limits may be exchanged for another sow, or arrangements made for rebreeding the original sow.

(8) In any adjustment, the seller reserves the right to take back the original sow and refund the entire purchase price.

Tips to the seller. (1) Promptness in furnishing a recorded pedigree certificate will result in a better satisfied customer.

(2) Always answer all correspondence promptly and courteously.

(3) Before shipping an animal, give a good bulky feed (such as oats, bran, or ground alfalfa) and plenty of water.

(4) If the animal is to be shipped by express, provide a strong but lightweight crate at least six inches longer and six inches higher than the measurement of the animal.

(5) Provide health certificates in compliance with regulations in states of origin and destination. Check with local veterinarian about this.

(6) Make suggestion to express agent that animal be kept away from drafts and steam pipes.

Tips to the buyer. (1) Isolate all newly purchased animals until danger of any shipping infection is past.

(2) When expecting shipment of a new animal for your herd, ask your express agent to notify you immediately on arrival.

(3) When an animal reaches your farm, give a mild laxative in first drink of water. Then follow with small amount of bulky feed such as warm bran mash. Do not allow a bred sow to drink ice water as long as she is in a restless, feverish condition.

(4) Unless otherwise agreed upon, return crate to seller.

(5) Do not under any circumstances allow a new boar to run with the sow herd.

(6) If for any reason there is a just complaint regarding purchase, contact the seller immediately.

Breeders' organizations. Other than the organizations for the recording of pedigrees, associations of many types are in exist-



Here we see a sale of purebred pigs held by an association of high school students.

ence. The membership includes those of a state, a district, or a county and usually is restricted to members breeding particular breeds. The functions vary, but usually have to do with sales, fairs, shows, and promotion. Many such associations for juniors have been developed as a part of high school vocational agricultural programs, and 4-H pig clubs.

Vocational agriculture swine association. In many high schools where vocational agriculture is taught, an organization of the students in a club or association is perfected by the instructor. A very successful association of this type, which was first organized in 1929 by Paul I. Barker, vocational agriculture instructor, exists at the Iowa Falls, Iowa, high school. Following is the plan of the organization and the program of work which could be followed, initiating such a plan.

1. This organization is made up of the membership of the class. A president and a secretary are elected for one year. A

careful account of the work of this association is kept by the secretary, including minutes of all meetings, names of all members of committees, reports of all committees, copies of all pictures taken, and a summary of all publicity relative to the organization.

2. Each member purchases two gilts through the association. The gilts are bought by the association through a committee consisting of four boys and their teacher. The gilts are delivered on a given day, and each boy receives his two at that time. The gilts are kept at home and handled and fed according to the best methods as determined by members of the class after careful study in the classroom and conferences with good hog men.

3. Each member turns in his share of the cost of a good boar, after which the association purchases a good, tried boar. This boar is kept by a man in the community, or by one of the boys, and is used on all of the purchased gilts.

4. (a) *All sows are insured in the following way:* Should any boy lose his gilt or gilts any time between the time of delivery and the end of the first week after farrowing, he receives one-half of the purchase price of the gilt from the association, this amount to be a pro rata to each member of the association.

(b) *All pigs are insured in the following way:* Should any boy lose any pigs between weaning time and the date of sale, or when they become six months of age, such pigs are appraised by the agriculture teacher and the two boys living nearest the loser on the basis of a well-matured and well-developed pig being worth \$35 at six months of age, this appraisal being recorded; and should the average price of hogs at sale be more or less than \$35, the appraised value of the lost pig will be proportionally raised or lowered; following which time the loss will be paid through an assessment of the membership according to the percentage his pigs are of the total number owned by the membership. In all cases, pigs must be vaccinated in order to secure protection.

5. A public sale of consigned stock from each young herd is held some time in the fall.

6. All members show some of their stock at the local fair in the fall. If any pigs are good enough, showing of pigs at other fairs is encouraged.

7. Every member keeps a careful account of all costs of production from the date of delivery until the date of sale in the fall. At this time the records of the year are closed and summarized for comparison.

The rules of the Iowa Falls Association have been changed as the association has developed. Co-operative feed purchases have been made and other projects initiated. A recent report from the association included the following summary.

The Iowa Falls Duroc Breeders' Association is an important part of the vocational agricultural program. It provides the laboratory facilities for training farm boys in regard to principles of co-operation, leadership, community service, business methods, methods of swine production, use of credit, business ethics, farm marketing, and farm records. It has assisted materially in developing interest in farming and in vocational agriculture. As a subsidiary of the local chapter of Future Farmers of America it has done much to assist in the accomplishment of chapter objectives.

SUGGESTIONS FOR FURTHER STUDY

1. Determine how many purebred herds of swine there are in your section.
2. Make a survey among market hog producers to find out the extent of crossbreeding in your locality. Also find out the breeds commonly included in crossing and the methods employed.
3. Look up the pedigrees of several prominent boars of the breed in which you are interested.
4. Write to the record association to get applications for registration.
5. Assist some of the local purebred breeders in the registering of hogs.

REFERENCES

- LUSH, JAY L. *Animal Breeding Plans*. Collegiate Press, Inc., Ames, Iowa
- RICE, V. A., FREDERICK N. ANDREWS, and EVERETTE J. WARWICK. *Breeding Better Livestock*. McGraw-Hill Book Co., New York

WINTERS, L. M. *Animal Breeding*. John Wiley and Sons, Inc., New York

WINTERS, L. M. *An Introduction to Breeding Farm Animals*. John Wiley and Sons, Inc., New York

United States Department of Agriculture:

Essentials of Animal Breeding. Farmers' Bulletin, 1167

1937 Yearbook of Agriculture

CHAPTER 17

Swine Shows and Sales

THERE ARE numerous swine shows or fairs in this country. In swine-growing areas there are local, county, district, and state shows. We also have national and international shows or expositions. F.F.A. and 4-H shows in recent years have taken on increased significance. Then too, swine sales are numerous; consequently it is important to discuss swine shows and sales.

Advantages of exhibiting at shows. There are many advantages which may come from the exhibiting of livestock at shows, but, of course, all exhibitors do not share equally in all of the advantages. Following are some of the things which may be gained by exhibiting livestock:

1. Fairs bring together animals representative of the various breeds for observation by interested persons.
2. Buyers and sellers of livestock are brought together.
3. Exhibiting is looked upon by most purebred breeders as a form of advertising whereby he may sell surplus breeding stock.
4. Livestock shows have a distinct educational value. Very few livestock producers who attend a fair do not gain new ideas concerning more efficient production.
5. Livestock showing sets measure of livestock values.

Ages and classes. Many shows have both breeding and market-show classes. The classification for each is included in the discussion that follows. Classes for junior exhibitors are in general different than those for open class exhibitors.



These swine are being driven out of the show-ring at the National Barrow Show, Austin, Minnesota.

1. Breeding hogs. The classes by ages at livestock shows are based upon the two common farrowing periods, spring and fall. Most shows are in the fall of the year at which time the spring pig crop of pigs are large enough for showing.

Spring pigs are now commonly put into two classes.

A commonly used standard classification for breeding individual boars and sows is as follows.

a. Definition of ages for breeding classes.

1. Aged boars and sows shall have been farrowed on or after August 1 three years previous and before August 1 two years previous.

2. Senior yearling boars and sows shall have been farrowed on or after August 1 two years previous and before February 1 of the preceding year.

3. Junior yearling boars and sows shall have been farrowed on or after February 1 and before August 1 of the preceding year.

4. Fall pigs shall have been farrowed on or after August 1 of the preceding year and before February 1 of the current year.

5. Senior spring pigs shall have been farrowed on or after February 1 and before March 15 of the current year.

6. Junior spring pigs shall have been farrowed on or after March 15 in the year of the show.

b. Group classes.

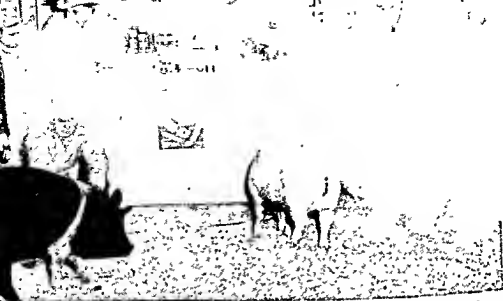
In many of the shows the number of group classes has been reduced. The following are retained by some:

1. Young herd shall consist of a boar and three gilts owned by exhibitor from age groups 5 and 6.
2. Get of sire shall consist of four animals either sex, the get of one boar, the property of the exhibitor, from age groups 5 and 6.
3. Produce of dam shall consist of four animals either sex, the produce of one sow, property of the exhibitor, from age groups 5 and 6.
4. Breeder, feeder litter shall consist of one boar, one gilt, and one barrow, the property of the exhibitor, all from one litter, from age group 6.

c. Champions.

1. Senior champion—first prize aged, senior and junior yearling animals shall be eligible to show for senior champion.
2. Reserve senior champion—animals eligible for senior champion and the animals standing second in class to senior champion are also eligible to show.
3. Junior champion—first prize fall pigs. First prize senior spring pigs and first prize junior spring pigs.
4. Reserve junior champion—animals eligible for junior champion and the animals standing second to the junior champion in class are also eligible to show.
5. Grand champion—any age.
6. Reserve grand champion—any age. The animals standing second in class to the grand champion are eligible to show.

2. *Market pigs.* Market pigs are mostly market barrows, but in some instances gilts are permitted in market class shows. Some shows are held in the spring of the year for fall farrowed pigs. Showing of market hogs puts emphasis on such hogs and are of incalculable value for hog producers. There is one group class in which both breeding and feeding pigs are shown. It is the breeder, feeder litter. Since these vary, prospective exhibitors



This shows placing the grand championship at the spring barrow show, Cedar Rapids, Iowa.

should secure the classifications in the premium list from the shows where they intend to exhibit. Championship classes are for the purpose of bringing first prize individuals together for competition. In breeding classes the junior champion is for the young or pig classes and the senior for the older classes (yearlings and older). The grand champion is the over champion of the breed and sex. Interbreed competition in breeding classes is not common. Reserves champions are for the second best and those standing second in class are eligible for such awards.

Market hog champions are between weight class winners, and there is interbreed competition for the grand championship.

At some junior shows a system of dividing the individuals into three groups is gaining popularity. This is an adaptation of the Danish system of judging. As used in this country the individual pens or litters are classified into blue, red, and white classes.

All shows do not have the same classes and there are often special classes in the various swine shows. The premium catalogs list the available classes and should be secured early from the fair secretary. The rules and regulations regarding pedigrees, vaccination, health certificates, pen rent, exhibitor tickets, and other matters are stated in the premium list.

Inexperienced exhibitors would do well to start exhibiting at the smaller shows in a moderate way to gain experience before starting out to a large swine show with a full show herd. Market

barrow showing provides a splendid avenue of entrance to the exhibiting in the breeding classes.

National swine show weights. For many years the prize winners at the National Swine Show were weighed. The show was held in late August or early September. The classification was on the base dates March 1 and September 1. The average weights are in Table 55. This information would be of assistance to exhibitors in determining about how much their various animals should weigh.

TABLE 55. AVERAGE OFFICIAL WEIGHTS OF THE VARIOUS CLASSES OF THE EIGHT BREEDS SHOWN AT THE NATIONAL SWINE SHOW

	POLAND- CHINAS	DUROG JERSEY	CHESTER WHITES	SPOTTED POLANDS	BERK- SHIRES	HAMP- SHIRES	TAM- WORTH	YORK- SHIRES
<i>Adult boars</i>	970	924	808	865	757	700	671	684
<i>Sr. Yr. boars</i>	771	775	659	707	642	551	551	564
<i>Jr. Yr. boars</i>	709	726	574	615	540	484	441	499
<i>Sr. boar pigs</i>	474	512	385	432	395	351	317	340
<i>Jr. boar pigs</i>	210	216	198	195	183	159	159	177
<i>Adult sows</i>	797	766	710	743	654	642	610	612
<i>Sr. Yr. sows</i>	675	702	610	656	580	528	530	529
<i>Jr. Yr. sows</i>	616	616	543	567	534	461	451	480
<i>Sr. sow pigs</i>	454	474	407	440	395	332	333	371
<i>Jr. sow pigs</i>	212	209	197	192	182	161	162	183

Selecting animals to be shown. Unless the breeder has had considerable experience, it is well to secure the advice of a capable judge as to which animals should be used in the show herd. In Chapters 3, 4, and 5, the qualifications for the different breeds and individuality for breeding and market hogs are discussed. A review of these points considered in judging should be helpful in making a proper selection of animals for showing. The individuality of the animals and the probable outcome are to be considered in making the selection. During the development of the

show herd some animals may have to be discarded. To be safe, more than one prospect should be selected for each class. Breeders should make selections early so that the fitting, finishing, and training may be complete before the time of showing.

The size of the show herd. It is economy to have a show herd which includes individuals for all classes and groups that will fill the group class. The cost for handling is not much more and the chances of winning are increased. Breeders should not take inferior animals to fill out the herd, but should plan ahead for show-herd needs.

Pigs for showing. Spring pigs are usually about six months of age at the time of showing, while fall pigs are about six months older. If the fitting is to begin about two to three months before show time, the breeder has but an approximate guide in the individuality of the junior pigs. Show men of experience usually select one or two litters from their best-producing sows and by an outstanding boar and feed the litters as prospective show litters. The pigs selected, in addition to being of the correct type and breed requirements, should be free of noticeable defects such as weak backs, heavy shoulders, light hair, weak heartgirth, crooked legs, or weak pasterns.

Boars for showing. A boar, yearling or older, may be improved by fleshing, but breeders cannot hope to make a show boar out of a poor individual. If the boar is not of good size and superior in conformation, fitting will not make him a winner. Select boars for showing that are large, well grown, typical of the breed, masculine, smooth of shoulder, have a well-arched, well-covered back, good-sized hams, strong feet and legs, a clean-cut head, and good vision. A boar that is weak in the legs or pastern will not show up well with heavy fitting.

Sows for showing. Yearling or older sows may have farrowed litters before showing. In fact, aged sows must have raised a litter in the last year, and in many shows senior yearlings that have raised and suckled litters are given preference in placings. Junior yearlings do not need to have raised or suckled litters but must show ample evidence of carrying a litter to be eligible to show. In case a sow is suckling a spring litter, it may be well to wean the pigs early so that the sow can regain her flesh and be in

good show condition. This is rather expensive and not so common as formerly.

Some sows show to best advantage when heavy with pig. This is true of rather rangy sows which lack depth of body. However, the more compact type shows to a disadvantage when heavy with pig. Open sows, those not with pig, are usually more

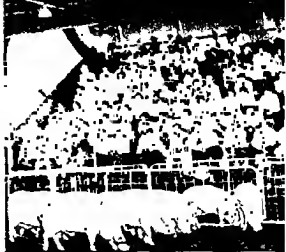
active and stronger on their feet and legs. Sows heavy with pig show more depth and udders of greater size and capacity.

A show sow should conform to the approved type and possess the typical breed characteristics. Heads lacking in coarseness, eyes large and clean, shoulder smoothly laid, back strong and fairly wide, sides smooth, deep, and long, udders with good capacity, and at least 12 teats, and well-set feet and legs are demanded in the modern type of show sow.

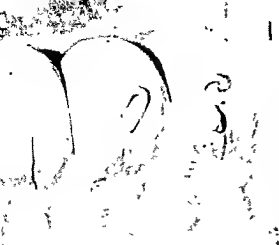
Barrows for showing. About the same things emphasized in the selection of pigs for show applies to the selection of barrows. A little less stress is given to stretch and more compactness tolerated. They may lack some in distinctive breed characters. In fact, grades and crossbreds are sometimes allowed in the market pig classes. See Chapter 3.

Groups for showing. The breeder must keep in mind the possible group classes in making up a show herd. Get of sire, produce of dam, young herd, and breeder feeder litter in the breeding classes, and pens and in the market classes, all make the best show when comprised of good individuals that are uniform as possible: size, form, and color.

Segregation of boars and sows. Even though there are but few animals in the show herd it is well to handle some of them in different groups. With the junior pigs, the boars should be separated from the sows when the pigs are four to five months old. The yearling and older sows may be kept together. If the fall gilts, senior pigs, are of good size and the group not large,



This is the truck-lot show at the National Barrow Show, Austin, Minnesota.



Here is a pen of grand champion market barrows. They are purebred Chester Whites.

they may also be included with the yearlings. Boars of different ages, from yearlings to the aged group, may be kept together. However, much depends upon the way in which the boars react to the grouping. Some boars must be kept separate to get them to finish well. If they can be kept together it is a great convenience because they handle easier in shipping.

Time to begin fitting.

There is no definite time

at which fitting or special preparations for showing should commence. Fitting is preparing the animal by feeding, finishing, and grooming so that it shows to the best of advantage. It involves getting an animal in the right degree of flesh and preparing the hair coat and feet so as to enhance the appearance and attractiveness. When swine are presented for exhibition, properly fitted, and shown, they receive the consideration their individual merit warrants. If they are poorly fitted and shown, their individuality is often underestimated. With some hogs carried in good condition, but a few weeks are needed to get them in proper shape for showing. However, six to twelve weeks are generally required for the usual course of fitting.

Sharp practices in fitting swine. Artificial means of removing or remedying physical defects of conformation are considered as sharp practices in fitting. Swine men seldom resort to these practices which are, of course, fraudulent. It is deception to remove a crease by the injection of an irritating drug. However, what is gained by such deception is not permanent.

Quarters for fitting. Feeding on pasture is highly important in fitting a show herd. At best there will not be over four or five groups, and these may be given a forage lot in accordance with their needs with but little expense and extra equipment.

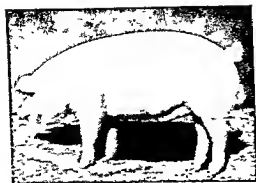
Alfalfa, clover, rape, or any swine forage suited to the local conditions will suffice. If dry-lot fed, alfalfa meal should be a component part of the ration. Movable houses of ample dimensions solve the housing problem. Sunshades are often necessary. Troughs, a watering arrangement, and a mineral-mixture feeder are also necessary parts of the equipment.

Feeds to use for the show herd. Many rations have been used successfully in feeding the show herd. Good rations are a necessity, but there are many combinations of feeds that have produced winners. The breeder must keep in mind that the pigs should be rapidly grown, rather than fattened. If the ration used tends to fatten the pigs, a change should be made. Usually the corn content of the ration is too high and this should be replaced with some good growing feed such as oats. Milk is a wonderfully good feed for this use. However, breeders should be careful not to use more than about three pounds of milk to each pound of grain fed. Pigs heavily fed on milk often become pot-bellied. A ration composed of corn, ground or rolled oats, wheat middlings, and a little linseed meal fed with skim milk or buttermilk usually gives very excellent results.

The following ration has been used successfully in fitting show herds:

	PER CENT
Corn ground-yellow	50.0
Wheat ground or wheat middlings	15.0
Oats ground	15.0
Tankage	7.0
Soybean oil meal	7.0
Alfalfa meal	5.0
Mineral	1.0

Common mistakes in the ration. Perhaps the most common error made in the ration for the show herd is the heavy feeding of a basal, such as corn. Show hogs can be fed corn safely if it is limited in the ration and properly supplemented. At least 50 per cent corn may be used in the ration without difficulty. Show hogs fed too heavily on corn are overly fat, lacking in size and outcome, uneven and soft in fleshing, and are weak-footed.



This is a properly fitted Chester White boar pig.

Training and exercise. If the show herd is on pasture, they usually take ample exercise. In case they do not take it voluntarily, they should be driven each day. This will improve the fleshing and make it even and firm. Exercise will also make the hogs more active, stronger on feet and legs, and far easier to handle on

the show circuit and in the show ring.

Petting of the pigs during the time of preparing for the show is to be guarded against. This makes a pig slouch down when any one comes near. Exercising is to be continued at the fair grounds to keep the herd in good condition.

Trimming the feet. This fitting operation should be finished a week before the show. Some hogs are quiet and their feet can be trimmed while they are lying down. Young pigs can be turned on their backs and held while the feet are trimmed. If very many hogs are to be trimmed, a lifting crate with a pulley is a handy item of equipment.

Trimming the feet is one of the first steps in preparing the show animal. Frequent attention is necessary to have the feet in best shape. If a small amount is taken off the underside of the foot each time with a rasp or sharp knife, the feet will be in good condition, and the hogs are not so apt to get sore footed. The outside toe does not wear off so rapidly as the inside toe; therefore it should be worked down with a knife or rasp, the breeder stopping just before the blood appears. Next, the inside toe should be worked down until both toes are about the same length and level. The toes should be so trimmed as to remove the greatest amount from the fore part of the underside. This tends to straighten the pasterns. Then shape the toes by rasping the outside wall. The dew claws may be shortened by trimming.

Removing tushes. Although a boar is gentle and easily handled, the tushes should be removed before he is taken to the fair.

Preparing the hair coat. *Shedding.* The coat of hair with older hogs may be rather troublesome. The old coats should be shed early in the summer to have a fine-appearing coat for the fall shows. Frequent brushings and oilings and occasional washing will assist materially in shedding the coat. Clipping should not be necessary, and it is inadvisable unless done early so there will be a good growth of new hair. Growth will usually take about two months. A clay wallow may help in removing the old hair. A long, rough coat of hair can be improved by grooming with sandpaper or emery paper together with a heavy oil. A good coat greatly improves the appearance of an animal.

Washing. With white hogs or hogs that are belted or spotted, washing is advantageous. The dark, solid-colored breeds are washed by some show men, but the practice in these breeds is less common than formerly.

Trimming. Often the ears are clipped and the long hair about the face cut off. This improves the appearance of hogs, especially those with coarse hair. A hand clipper or scissors may be used for the trimming.

Oiling. Before showing, the hair coat is lightly oiled. This may be put on with a brush, a rag, or a hand spray. Any light oil may be used for this purpose. Light paraffin oil is low in cost and very effective.

Powdering. White hogs or white spots on dark hogs are often powdered with talcum powder, cornstarch, or other white powder. This improves their appearance as it covers dirt spots. Bulk talcum powder is cheap and effective.

Parasite control. Breeders should be careful to check mange or hog lice on the show herd as these will harm the hair coat.

Entering at the fair. A premium list may be obtained from the secretary of the fair in which the hogs are to be shown. This is deserving of careful study so that proper entries are made in the various classes. Also note all of the provisions concerning swine. The rules and regulations regarding pedigrees, vaccination, health certificate, pen rent, exhibition tickets, and other matters are stated in the premium list. Make a careful study of these items.



This recent first prize winner is a Hampshire sow pig.

Shipping. Truck shipping, especially for short haul, has in many sections replaced shipping by railroad freight. This is due to the greater convenience of shipping by truck. Railroad shipments are preferred for long hauls. Box cars are to be preferred over stock cars, but side doors and end doors should be kept open most of the time. Removable partitions are needed in the cars to divide the hogs.

Feeding and managing at the fair. Feeding heavily just prior to shipping is inadvisable and often the cause of overheated animals when shipping in warm weather.

After the hogs are located in their pens at the fair, light feeding is advisable the first day. Beginning the day after arriving, the usual amount of feed may be given with safety. Feeding twice daily is the usual plan, and if possible breeders should feed outside the pens. Hurdles are very convenient for confining them while they are being fed. The time of the morning feed is a good time to clean out and re-bed the pen. The final washing may be done a day or two after arriving. Each day the coat may be brushed, and the dark breeds oiled and the white breeds dusted with white powder.

Showing. If the pigs or other hogs have been trained at home, the showing is not a difficult task. The purpose of showing is to make the animal appear to the best advantage to the judge. The show man uses a whip or cane to move the hogs about as desired. Hand hurdles or shields are used for boars if they are hard to handle. Breeders must watch the hog and also the judge to be an expert showman. Practice is necessary to become expert. Above all, be a good loser and profit by experience.

Disease prevention. Hogs which are shown at most fairs are immunized against hog cholera in accordance with the rules pertaining to health certificates. As there is more or less danger

from this disease it is the safest plan to immunize pigs that are to be shown at any fairs or shows. The most prevalent of swine diseases around the fair ground is hog "flu." This is a disease of the respiratory tract and is characterized by coughing. Very little is known concerning this disease, but it has been observed that

reduction of the feed and not disturbing the sick one is the best method of handling. It pays to be very careful in disinfecting cars, trucks, or pens in which the show hogs are shipped or transported.

After the fair. When the hogs have been returned from the fair, it is well to quarantine them for a few days from the remainder of the herd. This prevents the spread of diseases which might have been acquired by the show herd. The amount of feed is to be lessened and rather bulky rations should be used. Pasture feeding is to be preferred, and with rather limited concentrates the show herd may be reduced to breeding condition in a short period.

R. L. Pemberton, Secretary of the Hampshire Swine Registry Association, has made the statement that follows concerning the showing of pigs.

Be on hand when it is time to show. Other people are busy and haven't time to chase down every boy. Have your pigs ready at least an hour prior to the show. A little brushing the last minute is in order. Have the hurdles handy so you can get your pig into the show ring without running it. If your pig gets away and runs, it gets hot, to say nothing about yourself, and neither you nor your pig are fit subjects to go before the judge. This represents your final effort, and oftentimes avoidable conditions ruin all your chances.

When the judge is looking at your pig it should be between you and the judge. The animal should be kept out in the open



This is a Spotted Poland-China sow, recently a grand champion.

so he can see it. Try to keep it in a natural position either walking or standing, and keep your hands off the pig. As a rule, the handling of a pig with your hands is detrimental to its appearance, in that it makes the animal look "sloppy." Do not stop the pig and back him up, as this makes him look bad on his pasterns. Attempt to keep the pig at least 10 to 15 feet from the judge. It is poor showmanship for an exhibitor to be continually crowding around the judge. If the judge cares to put his hands on the animal, he can easily do so. It is desirable to move the pig about to present it to the best advantage. Keep cool, and if the judge asks that the pig be moved, do so promptly and in a courteous manner. Be a gentleman at all times. Take the judge's decision as final. He is in a position to see all the pigs to a better advantage than one who is showing. Everyone cannot win, so in case you do not win, be a gentleman and do not criticize the judge. A good motto is: "To Win Without Bragging and Lose Without Squealing." Do not neglect your pig and the pen after the showing has been completed.

SUGGESTIONS FOR FURTHER STUDY

1. Attend some fair in your locality, visit the hog exhibits, and observe the hog judging.
2. Make a list of materials needed in fitting a litter of pigs for showing.
3. Outline a plan for fitting and showing of pigs for both market and breeding classes.
4. Assist in training, fitting, and showing some hogs to be shown at a fair.
5. Secure premium lists from county and state fairs and make up an entry list from your herd, showing the dates of farrowing for animals to be entered in each class.

REFERENCES

- BEELER, M. N. *Marketing Purebred Livestock*. The Macmillan Co., New York
- NORDBY, J. E. and H. E. LATTIG. *Swine, Selecting, Fitting and Showing*. The Interstate Printers and Publishers, Danville, Illinois
- PLAGER, CARROLL. *Manual for Livestock Showmen*. George A. Hormel & Co. Minnesota
- United States Department of Agriculture:
Fitting, Showing, and Judging. Farmers' Bulletin, 1455

CHAPTER 18

Swine Housing and Equipment

THE HOUSING and equipment should be planned so as to reduce to a minimum the amount of labor required for hog raising. The raising of large litters and the avoiding of diseases and parasites are major considerations in deciding upon equipment as well as housing. Many of the common diseases and parasites can be controlled by good management, proper housing and use of equipment, and adequate feeding. Expensive housing and equipment is not necessary. Many successful hog raisers use only the movable houses. Economical housing is essential for profit from the hog enterprise. Successful livestock farmers house their hogs for about 6 per cent of the yearly income from hogs. In other words, if the yearly income from hogs is \$2000 the housing cost should be about \$120.00. That amount should pay for maintenance, taxes, depreciation, and insurance of the housing. The plan of hog raising and the methods used determine to a large extent what is needed in the way of shelter and equipment.

HOUSING

Hog-housing. There are two kinds of hog houses: (1) the central or community house, which may have several farrowing pens; (2) the movable house, sometimes referred to as the individual or colony house. Movable houses are often brought together in a centralized fashion. Further fairly large movable houses are now being made, those with four farrowing pens are



Clay Equipment Corporation

A modern central hog house is used mainly as a farrowing house. A farrowing house is very useful for early spring farrowing.

not uncommon. Then too, there are many kinds of sectional houses which may be regarded as semimovable.

Need for housing. Proper protection is essential in hog raising. The hog requires more protection from the cold weather than other farm animals because of the rather thin hair coat. In hot weather hogs suffer from the heat. It is evident that ample shelter may save feed, provides comfort, and provides healthful conditions which permit proper growth and development. The shelter to be satisfactory must protect against cold, heat, dampness, winds, draft, and filth.

Functions of a hog house. In a recent publication of the U. S. Department of Agriculture, *Hog-Housing Requirements*, the functions of a good hog house are listed as follows:

1. Provide pens, floors, walls, ceilings, and equipment that can be cleaned so as to prevent disease and to control parasites.
2. Provide adequate space for the animals.
3. Protect the animals from cold, wind, rain, snow, and excessive summer sunshine.
4. Maintain air temperature, humidity, and air movement within limits conducive to the health and comfort of the animals.

5. If a central house, have adequate light for performance of work.

6. Provide for safety of the animals and of persons, both from injury by animals and by contact with the structure.

Fall-farrowed pigs if properly handled will make as rapid and economical gains when housed in portable houses, as those in central houses. Freedom from dampness, good ventilation without drafts plus moderate temperatures are needed for satisfactory housing.

It must be recognized that sows and pigs in movable houses may require more feed than those in a central house. The increase in the feed needed from the lack of shelter is directly related to the severity of the season. In cold winters, in northern states, good shelter may save 25 per cent or more in the feed bill with sows or fall pigs.

Kind of protection needed. It is obvious that the protection needed against cold is affected by the lowness of the temperatures as well as the snow, rain, and wind. In the northern part of the United States there may be months of the year when pigs should be indoors most of the time. In the south swine can spend the greater part of the day outdoors in the winter, but protection is needed against rain and wind.

It has been found that feeding indoors in winter may save a considerable quantity of feed for growing and fattening pigs. Even with bred sows there may be some of a feed saving but this might be offset by the beneficial effects of exercising outdoors during the day. Sows housed in portable houses and fed outdoors get exercise, are exposed to sunlight, and may supplement the ration by feeds picked up in the lot. This may result in larger more vigorous litters. When confined indoors a more complete ration is needed because it must supply some of the things acquired on the range, sunshine and vitamin D for example.

Portable houses can be made quite comfortable for pigs by using a sack for the door cover and banking up the house.

Movable houses can be used successfully for farrowing in the early spring during cool weather if some supplementary heating such as electric pig brooders are used.

Combination of housing systems. Even though a central hog house is available it is unwise to depend upon it alone for housing the hogs. A combination of the two types of houses is generally used by hog men. As previously pointed out, each type of house has advantages and disadvantages, and by a combination plan one type can supplement the other. Movable houses alone can be used by small producers, in sections having favorable weather, or if late-farrowed spring pigs are raised. The central house cannot be successfully used as the sole housing for swine without concrete lanes to the pasture because of the impossibility of providing clean ground.

Advantages of the central house. Where hogs form a major part in the farm plan a central house is usually indicated, especially if early farrowing is practiced. However, in order to compare the two general systems it is well to look into the advantages and disadvantages of each type. Following are the advantages of the central hog house:

1. Sanitation of interior and lots. A thorough cleaning of the farrowing pens is possible because of the smooth floors and walls. The manure can be removed, and it is less work to keep clean. However, the total of sanitation, considering both the inside and outside may be against the central hog house if it is surrounded with filthy lots. These lots can be a source of a great number of diseases and parasites.

2. Time and labor. With all things under one roof all of the operations in feeding and management can be carried out with less time and labor, and each operation can be more efficiently done.

3. Durability. Construction is more substantial, consequently gives more permanence to the building.

4. Ventilation. The principles of ventilation are more easily followed in a large-sized building, and outlets and intakes may be properly placed and adjusted to the needs, giving a more efficient ventilating plan than is possible with the movable houses.

5. Heating. Movable houses are not so suited for heating as there is but a small amount of space and rather open con-

struction. However, because of the smaller space less heat is needed.

6. *Close attention possible.* This is especially true at breeding time. Stockmen can care for several sows in a series of pens, while if individual houses were used less attention would be given each sow and litter because of the inconvenience and time involved. Close attention to the herd can be given with greater ease.

7. *Sunlight in the pens.* Movable houses are not adapted to the use of windows as are central houses. Sunlight in the pens is secured with difficulty in movable houses unless roof doors are available and can be used.

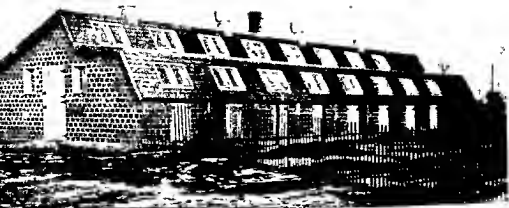
8. *Center of swine-feeding management operations.* Decentralization results when hogs become more widely distributed. There is an advantage in having one central point from which all operations radiate. Records are kept in the one place as well as all items of equipment used, all supplies, feed, and other materials.

9. *Less equipment required.* With hogs distributed, more troughs, feeders, and waters are needed. Also, the owner needs equipment to transport these items to the outlying hog houses.

10. *Advertising value greater.* To the breeder of purebred hogs this is a distinct advantage. A large, well-equipped central hog house has an appeal to those in the hog business and carries a strong, positive advertising value.

Location of the central hog house. A carefully planned farmstead gives a distribution of buildings, which tends to bring efficiency and economy in operation. The most important factors which affect the locating of the hog house are: (1) lay of the land, a south slope with ample drainage being preferred; (2) nearness to the other farm buildings, especially the corn crib; (3) distance from the house and poultry house; and (4) nearness to the windbreak, and also shade for the pasture lots.

Kinds of central hog houses. Several varieties of hog houses are successfully used. In the following discussions the common types will occupy our attention:



This is a modification of the half or semimonitor hog house. The common half-monitor house has perpendicular roof windows. The roof windows are set on an angle in the above half-monitor house.

The round hog house. But few hog houses of the round hog house type have been built in the last few years. The merits of this type are that it is economical and that it can be made into a sale ring. The common objections are the uneven sizes of pens if two rows are included, and the uneven distribution of sunlight. This type of house is not so easily enlarged as are some of the other kinds.

The half-monitor type. The half-monitor type shown on this page extends east and west and has the two rows of windows exposed to the south. It is adapted to two rows of farrowing pens with a feeding alley through the center. The house has an advantage in distributing the sunlight into both rows of pens, but there are places not reached by the sun. In midsummer, because of the perpendicular windows, there is less direct sunlight through the glass, which is an advantage. It is necessary to alter the location of the windows in accordance with the latitude to get the sunlight properly placed for the farrowing season. In the central part of Iowa, about 42° north latitude, on March 1 the rays of the sun come in the window at noon at an angle of $40^{\circ} 30'$, while two hours later or earlier the rays enter at a 35° angle.

Disadvantages of the half-monitor hog house. A large quantity of glass is required in the half-monitor hog house. This not only adds to the cost but also increases heat loss from radiation. In ease and cost of construction some of the other houses have an advantage. Although there is much overhead space and more than in some of the other kinds, there is a lack of overhead

space in the pens. For this reason the pen doors cannot be raised by an overhead rope pull from the feeding alleys. The outside pens on the north side of the house are

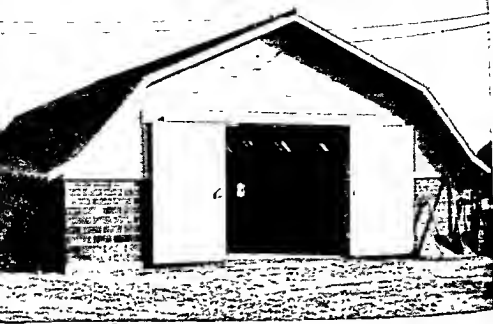


This central hog house with adjoining concrete lots is suitable for farrowing and winter feeding.

not very desirable because of lack of sunshine exposure and too much exposure to cold winds. This house has much glass and overhead space, and consequently it is difficult to heat.

The sunlit hog house. Many modifications have been made on the original Iowa sunlit plan of house, illustrated on this page. In fact, almost any hog house with roof windows is called a sunlit house. The amount of sunlight provided by this type of construction exceeds that of most other types. This is dependent upon the windows included in the structure. On pages 379 and 380 a marked difference is shown in the number of windows and their location, being suited in one for an east-and-west setting and in the other for a north-and-south setting. The roof has been changed in these two houses, in keeping with the modern gambrel or two-pitched roof trend in sunlit-type architecture. They both have hip roofs, whereas the original Iowa sunlit had a straight gable roof. The advantage of this kind of roof construction rather than the straight roof is that it gives greater overhead space in the farrowing pens, and it is, therefore, possible to use sliding outside doors with overhead pulls. This kind of house can be used for three rows of farrowing pens.

Disadvantages of the sunlit type. If extended north and south the sun may not shine into the east and west pens at the same time in the sunlit house. The number of windows is about twice that of a half-monitor type or the type turned the other way. It gets very warm in midsummer.



Clay Equipment Corporation

This extension is a sunlit type adapted east and west. Roof windows are on the south side only.

The turned-sunlit or combination-sunlit type. The combination-sunlit house is extended east and west and has the windows on the south side, both wall and roof, in addition to the windows in the end. This is illustrated on this page. This house combination has several advantageous features: (1) ample headroom in the pen, (2) minimum of glass, (3) minimum of overhead space, (4) sunshine through the glass at all times of the day, (5) roof self-sustaining and therefore there are no objectionable cross braces. A minimum of heat is required, and the cost is relatively low. This house furnishes space per pen more economically than most houses.

Combination half-monitor and sunlit type. The house shown on pages 382 and 383 is a rather recent development in swine-horn construction. It extends east and west, having the two rows of windows facing the sun. The general plan was developed at the University of Missouri, and it has been rather widely used in the central states. It has none of the side-wall windows as used in the half-monitor type, and the roof windows are placed at right angles with the sun rays. This insures maximum utilization of sunlight in early spring. Window placement as in other hog houses, should be determined accurately from the latitude, the dimensions of the building, the length of the windows, and

the date of maximum need for sunlight.

Other types of central houses. Other types of hog houses are built and are rather common in some regions. The two-slope-roof type is common and is a proved type of construction. Modification of the half monitor into a "saw-tooth" effect is also used.

Floors for the central houses. Concrete floors, because of their cleanliness, are a decided advantage in a permanent structure like a central house. The main disadvantage with this kind is that they are cold. This may be counteracted in several ways:



Louden Machinery Company

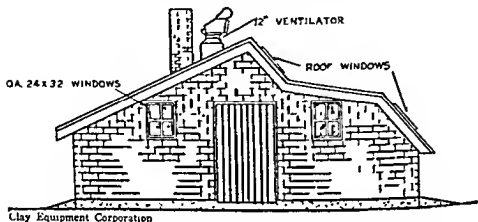
This sunlit house is placed east and west. A common type of hog house, it is adopted to be placed east and west, there being no windows on the other side. A modification of roof and side wall windows would be necessary to adapt for a north and south extension.

1. Plank overlays can be used.
2. Hollow tile can be laid just under the cement.
3. Cork, brick, or wood block may be laid on the cement.
4. Paper or tar insulation placed under the top finish may help.

Floors made from hollow tile alone are lacking in permanency and are likely to harbor rats. Wood floors are but short-lived in hog houses and are also faulty in that they are slippery when wet, difficult to keep clean and sanitary, and not very satisfactory if rats are present. Dirt floors are used in a great many hog houses and are quite satisfactory. Lack of cleanliness, sanitation, and convenience are the objectionable features in such a floor. Slippery, wet floors invite accidents.

Ventilation of central houses. In houses such as have been described ventilation can be accomplished with a rather simple system. Openings of about one square foot inlet should be provided for each pen. These may be placed at alternate pens and an air inlet brought in through the outside wall, just under the

eaves, near the center of the house, between the rafters. Intakes are very often equipped with automatic dampers to prevent back drafts, or adjustable dampers to regulate the intake. Outlets for foul air connecting with cupolas on the roof should be equal in area to the intakes. These should come down to within



This shows the end elevation of a sunlit hog house. The roof windows are on the south side and set to get maximum sunlight.

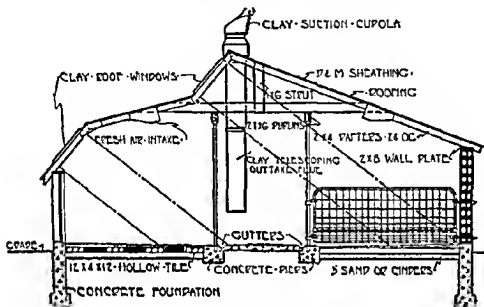
12 inches of the floors. Telescoping grain sacks which drop down in the center of the feed alley may be used very well for the outlets. During the summer they may be taken down. Outlets constructed of metal or lumber may be extended along the inside of the roof and dropped down at the pen fronts. These should be constructed so that they may be collapsed or removed when not in use.

Mechanically operated¹ or fan-type ventilation systems are by far the most positive and satisfactory. These systems are usually installed by a commercial company and are designed to meet the needs of each individual building. A farmer desiring the most successful and positive ventilation system should consult one or more of the commercial firms making such equipment.

Such equipment is usually operated by instruments or controls sensitive to temperature or moisture and thus maintain correct conditions in the hog house under all weather conditions.

¹ *Hog House Ventilation*. Iowa State College.

Insulation of the central hog house. The heat loss from a swine barn can be reduced by insulating the walls and ceiling or roof. The hog house may have quite a loss of heat from poorly fitting doors and windows and other causes which might offset the effect of insulating. Consequently, the hog house should be

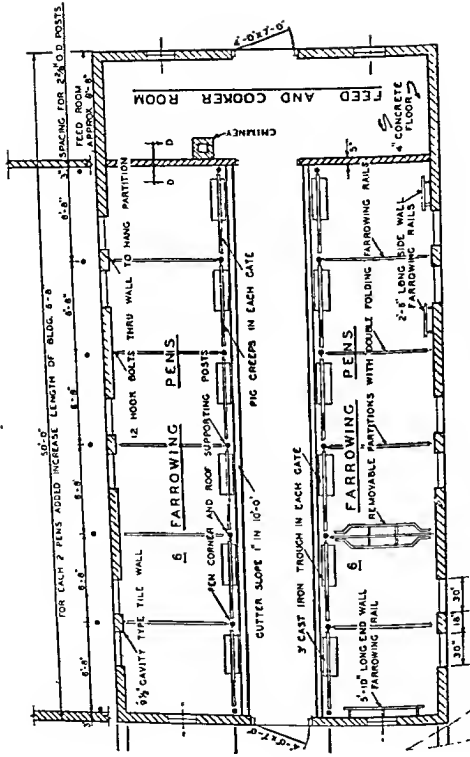


Iowa Gate Company

Here we see a section of a combination house. Note the general construction, especially the location of windows and ventilator system.

well constructed as well as insulated to conserve heat. Proper insulation will reduce condensation of moisture on the ceiling and facilitate ventilation as well as conserve heat.

Size of central hog house. The number of pens provided for farrowing is dependent entirely upon the size of the herd. Breeders should plan to use the house to the maximum capacity during the farrowing seasons and for winter protection of the herd. Most houses are made too small to meet the demand for housing space. The length is varied according to the number of farrowing pens needed. The floor plan on page 381 has a length of 50 feet over-all and has two rows of six farrowing pens eight feet wide. Six-inch walls are included in the total length. If 16 pens

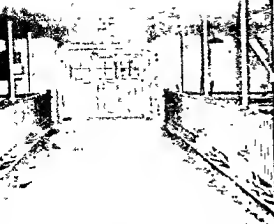


are required, this may be provided by greater length. The width depends upon the feed alley width, the pen width, and the walls. Most houses are built on the same general floor plan as shown on page 384 and have but two rows of pens. The width of this plan varies from 22 to 26 feet. The alley is the determining factor in the matter of width. If a four-foot alley is used, a 22-foot width will suffice. This is a cheaper construction than an eight-foot alley. However, the latter permits the use of a wagon in the hog house, whereas with a narrower alley the cleaning is done by means of carts or wheelbarrows.

Size of farrowing pens. This is dependent upon the size of the brood sows that will farrow in the pens. Pens six by eight feet are rather small, although pens of this size are used in many houses. For the usual brood sow, a pen eight by eight feet is to be preferred. Even larger pens may be indicated if many large-size sows are in the herd, as is often the case in the purebred breeder's herd. Removable partitions allow the enlarging of pens, as is desirable in housing lots of fall pigs in winter, or in housing a bunch of fattening pigs. See pages 152-153, "The farrowing stall."

Pen equipment. Each pen should have guard rails, and for early farrowing pig brooders. Pipe or two-by-four pieces of lumber are commonly used for guard rails. The rails are placed about eight inches from the floor and the wall. In some central houses the pen from has a built-in feeding and watering trough. This is a necessity unless the sows are fed outside of the farrowing pens. This plan is increasing in usage. The sows are commonly fed on the feeding floor just outside the barn.

Construction materials. This should be decided on the basis of the other buildings on the farmstead. The architecture and material should be in keeping with the other farm buildings. If hollow tile predominates, it should be used for the side walls, or the side wall may be made of concrete blocks, or of monolithic concrete. The two latter are, in most sections, more expensive than hollow tile. Permanency and fire resistance favor the selection of hollow tile or concrete, but initial cost is usually in favor of frame construction. There is but little difference in the houses built of hollow tile or concrete and those built of lumber other than in the side walls.



Clay Equipment Corporation

The inside view of a modern hog house is pictured here.

Drainage and water supply. A supply of water in the house is of great convenience. This is of value in watering the hogs and also in cleaning the alleys and pens. Care should be taken in laying the floor on a slope to the drain, as this helps greatly in keeping the floor dry and clean. Drains may be provided for every

two pens, or a trough in front of the pen may be pitched to conduct the liquid to one drain on each side of the house.

Outside doors. Ample size of the door is the outstanding essential. It is very convenient to have the sliding type of door, operated by ropes from the alleyway. If overhead space lacks for proper ventilation of straight doors of this kind, two or three hinged breaks in the door will overcome the difficulty. Outside doors are most often arranged equal distances apart of the side. There is some advantage, from the standpoint of warmth, in having them in pairs. The distance between the doors is then doubled.

Storage space. Unless the hog barn is near to or adjoining some other farm building where storage is available, storage space should be provided. This may be accomplished by using one of the pens. Straw, feed, equipment, and many other things are kept in this storage space.

Heating. Many extensive heating systems are in use in heating hog barns. The need, of course, is determined by the climatic conditions and the earliness of the farrowing season. The usual way of solving this problem on the farm is to set up a furnace or good-sized stove in the feed alley or in one of the pens.

Window glass. New types of glass are available for hog-house use. Ordinary glass lacks strength for use in roof windows, especially in regions where hail occurs. The heavier glass which is less transparent and diffuses the sunlight is more durable and advantageous in the hot summer weather. Shades are a great

help if the house is used extensively in the summer. As large panes of glass expand and contract, expansion room is a necessity.

Glass substitutes. Glass substitutes are more widely used in the movable and semimovable hog houses. They may be advantageously used, cost considered, but lack somewhat in permanence, and most kinds are not suitable for anything but perpendicular installations. They are not very satisfactory for roof windows or for use when the window frame is in any position other than vertical. During midsummer the frames with the glass substitute should be removed and stored as the continuous direct sunlight may destroy the material.

Value of sunlight. Some kinds of glass substitutes admit the ultraviolet rays (short rays) which stimulate the fatlike substances in the skin of animals and give rise to vitamin D. This is known as the antirachitic vitamin, for in its absence types of rickets may occur, as leg weakness in growing chicks. It also affects growth and the well-being of the animal. Ordinary window glass does not admit an appreciable amount of the short rays. The long rays of the sun (infrared) have a stimulating effect upon animal growth, but they do not have any antirachitic influence. Sunlight, besides having the stimulating growth-promoting and antirachitic properties, also is of great benefit in destroying disease organisms and producing more healthful conditions. Direct sunlight unfiltered by glass or glass substitutes is decidedly preferable when possible.

Advantages of the movable or colony house.

1. *Clean ground.* With movable houses the hogs can be put out on clean ground and the McLean County system of parasite control can be followed. The location can be changed to suit the sanitation plan.

2. *Isolation.* There is some advantage in segregating sows with newborn litters. Diseases among the pigs, such as scours, can be controlled with greater ease.

3. *Ease of construction.* Movable houses can readily be constructed on the farm and the number can be increased gradually to suit the needs.

4. *Lower cost per number of hog houses.* For this reason it is especially adapted for use with small herds and by beginners.

5. *Less fire risk.* With the small houses of the movable kind distributed over an area the risk of fire damage is considerably lessened.

Kinds of movable hog houses. The first types of movable houses made and advocated were of the one-sow size and were commonly called individual houses or hog cots. Large-sized houses have come into use, and we now have houses of this kind up to the three-sow size, which is at least 16 feet long. As much variety exists in houses of this kind as with the central houses. Only the general types are here discussed. These general types are modified in many localities to meet local conditions. Houses of this kind are manufactured at many places.

Movable hog houses increasing in usage. With the plan of rotating swine pastures becoming more widespread, there is also an increase in the number of movable hog houses used. Central houses with this plan also have a short period of usefulness in the year. Disease and parasite control are the outstanding advantages in the rotating-pasture plan, and these come from the use of the clean ground rather than from the use of the movable house. Houses of this type are almost a necessity in pasture rotations as to use a central hog house and clean pastures is almost impossible. The passing of hogs through old lots from the central house to the clean ground would defeat the purpose of the plan as they would soon pick up parasites and disease harbored in the filth of the old wallows and runways. Even though the use of movable houses may involve more labor, additional housing expense, more exposure of the caretaker, less efficient ventilation and sunlight in the pens, more equipment, and greater distance from feed and water, the value of clean ground and related advantages makes their use imperative. The use of movable houses on clean ground marks a progressive hog raiser.

The A-type movable hog house. The A-type house is one of the movable houses. The popularity of this house is no doubt based upon its simple construction, low cost, handy size, and general adaptability. Due to the sloping wall, houses of this kind

lack some in the space which may be used by large-sized hogs. For sows with litters this is an advantage, as the sloping walls act as a pig rail. A pig rail should be included on the rear wall. The door being in front and the small amount of fixed wall space makes it unnecessary to provide a rail in front. A house should have side doors and a small door in the rear. Gable ventilators should also be included in the structure. This general type is shown on this page.

A-type house disadvantages. Although excellent and economical as a source of housing, the A-type house is not usable as a sun protection, a feature included in other kinds. One great trouble encountered with houses with the boards extending from the peak to the floor line is that the boards may be pushed off by hogs in the inside or knocked off in moving. Most A-type houses are rather small in size for a large sow, yet the size may be increased to accommodate the size of sows in the herd.

Box-type movable houses. The box-type also has many modifications. Some are built with a gable roof and others with a shed roof. There is more space in this house which can be used by large-sized hogs than there is in several other types of houses. Guard rails are a necessity if the house is used for sows and pigs. This house is more expensive than the A-type of house and requires about twice as much labor to build. If built with sides that can be opened, it is of decided advantage over the A kind



Straw banks a movable house. Note the woven-wire fence holding the straw.

as a source of shade. This house is shown on page 391. Its construction is shown on page 392.

Materials for single-sow, box-type, gable-roof, movable house. The following list of materials is needed for the building of a box-type, gable-roof house with 6' \times 8' floor and a height of side walls of 2' \times 6".

- 1 piece 4" \times 4" \times 16' for runners = 21 $\frac{1}{3}$ board feet
- 4 pieces 2" \times 12" \times 12' for floor, No. 1 white or yellow pine = 96 board feet
- 1 2" \times 4" \times 8' for floor stiffeners, No. 1 white or yellow pine = 5 $\frac{1}{3}$ board feet



This is a gable-roof, box-type portable house. The roof door is open, showing how it may be opened up for cleaning and airing.

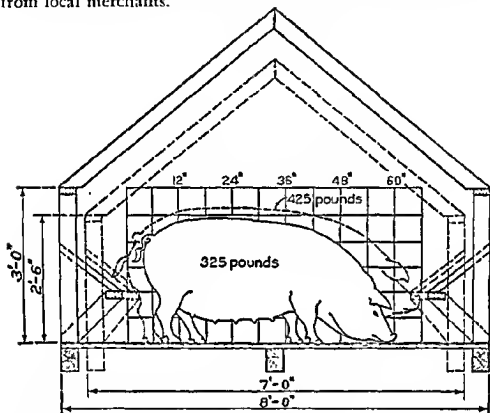
Two-sow box type. By doubling the length and using a removable division hurdle, we can build a very satis-

factory house for two sows. This will lessen the cost per housing of each sow and pigs. Difficulties arise in trying to house two sows together, unless separate pasture lots are available. Often the sows and pigs bunch together and there may be more or less robbing; that is, some pigs will suckle both sows. When the house is made double, two doors are made on the south side and large roof doors are included.

Other movable houses. Pages 394 and 396 show other kinds of movable houses. These houses are in wide use in parts of the corn belt.

Problems.

1. Make a bill of materials and determine the cost for 7×5 foot, A-type, movable hog house, securing prices of materials from local merchants.



U. S. Department of Agriculture

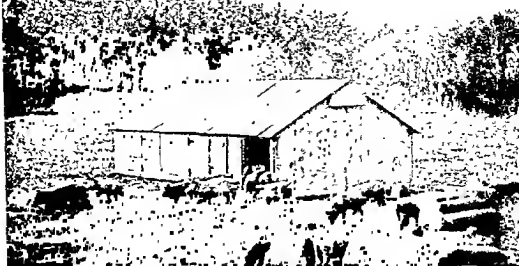
This diagram shows the dimensions of sows of two sizes in relation to a box-type house.

2. Make a bill of materials and determine the cost for a box-type gable-roof house 6×8 feet.

3. What saving in material could be made by using a shed roof on a 6×8 foot, box-type house?

4. With the prevailing prices for lumber, what would the material cost for constructing a shed roof, two-sow house of lumber as illustrated on page 391.

5. Compare the types of houses in the previous problems as



This is a three-pen hog house.

to construction cost. (Secure estimates, if possible, from local lumbermen, carpenters, or contractors.)

6. Compare the types of hog houses as regards the cost of housing one sow.

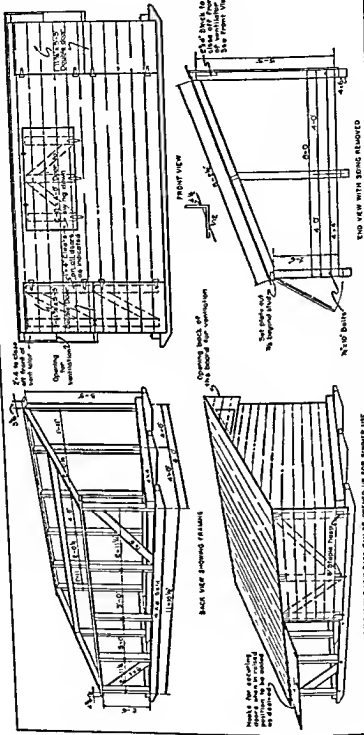
Construction features of movable houses.

1. *Floors.* Although a floor is not a necessity, it adds greatly to the value of the house in increasing its rigidity, or strength. In wet, cold sections, floors are valuable, and if dry and dusty, floors add to the cleanliness. Floors add to the cost and under many conditions will not pay for themselves.

2. *Doors for pigs.* The openings should be ample for the size of the pigs. Swinging or sliding doors are used, the latter having the preference, but of course they cannot be used on all kinds of houses. Most of the year the doors are kept open except for young pigs or when the weather is too cold. Double sacks hanging in the doorway serve well as a door to keep out the cold and will not injure pigs in swinging. Doors are put on most movable houses, but in actual practice they are used but very little.

3. *Doors for sunlight and for shade protection.* These are essential for a first-class house. Roof doors allow air to get out of the house, and allow the entrance of sunlight. Side doors may be swung out and held with wires or rods so that greater shade is available. All of these add to the convenience of caring for the house.

4. *Runners.* Runners are included on all of the suggested



plans. Small houses may be readily moved with a team any usual distance. Houses to accommodate two or more sows are quite heavy, especially if the plank floor is included. Four horses or a tractor are needed to move them any distance. They are also more cumbersome to handle, especially at gate corners.

5. *Ventilation.* This item is provided on all plans herein included. Even though there be no door, a ventilator should be made on either end at the peak of the roof.

6. *Painting.* Painting pays from the standpoint of longer life, and it also adds greatly to the appearance. The insides of some houses are treated with creosote, crude oil, or other wood preservatives. Creosote may cause irritation of the feet of young pigs and should be used with caution.

7. *Roof materials.* A roof should be watertight. Although boards make a relatively cheap roof, unless they are well laid and of good material, such as six-inch flooring, leaks will soon start. Roofs with doors are especially difficult to keep waterproof. Prepared roofing may be used over old roofs or put on when built. Metal strips over the joints in the roof boards are used. All metal roofs, although durable, are inclined to be hot in summer and when laid over boards may cause the boards to decay more rapidly.

The movable house in winter. Although hogs have very little protection in the way of a coat, they are very often housed in movable houses the entire year, even as far north as Canada. For winter use, tight construction is necessary and there should be a door. Sacks or other cloth material will make an ample self-closing door. A board may be attached to the end of the sack, giving more weight and thus holding it in place in spite of winds. The house may be banked with straw. This is shown on page 389. It adds greatly to the warmth of the house. Heating is rather difficult without electricity and brooders; lanterns hung inside may be used in emergencies.



This is a four-pen movable hog house.



This is a three-pen movable hog house with shed-type roof. It is suitable for farrowing or housing growing and fattening pigs.

of this kind have been round or hexagonal in shape. This shape lends itself to the division into six farrowing pens and the inclusion of a brooder house stove or electric pig brooder in the middle. Houses of the box type are now being adapted to this general plan. Five or six houses of the box type are grouped around one house which is heated and serves as a pig brooder house.

EQUIPMENT

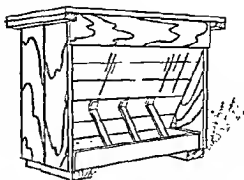
Equipment for swine raising. In the preceding section, swine barns, both central and movable, were discussed along with the equipment needs. This discussion deals mainly with equipment outside of the hog barn. Electric pig brooders are included in Chapter 8.

Progressive hog raisers are continually on the outlook for equipment that makes herd management more efficient. Money expended in such equipment brings a good return, by saving time and by greater productivity of the hogs. Many of these items of equipment can be made at home at a minimum cost.

Self-feeders for swine. There are many advantages in the self-feeding method. The increased usage of this equipment is due to the saving which may be effected in feed, time, and labor. Market pigs self-fed almost always make more rapid gains and use less feed for a unit of gain than hand-fed pigs. All classes of hogs are not adapted to self-feeding. Many commercial feeders

are on the market and they are of a great variety in mechanism, size, and construction material.

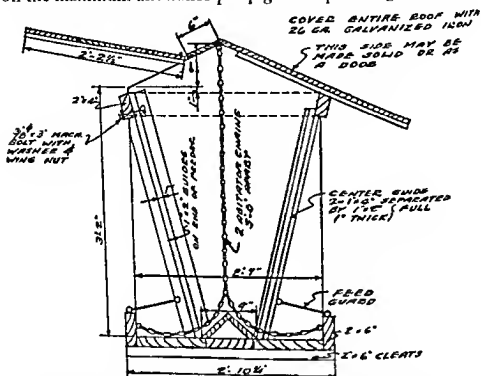
Essentials of a self-feeder. A feeder, to be satisfactory, should keep a supply of feed accessible to the pigs at all times. It should offer ample protection to the feed contained in the feed hopper and trough from wind and rain. The hopper should feed into the trough in sufficient amounts. An adjustable throat is needed for various feeds, and an agitator is necessary for some feeds to insure constant feeding. The capacity for feed or size of the hopper should be large enough to hold several days' feed. The trough can be constructed so that there is but little feed wasted, and protection for the feed in the form of a lid or flap is highly desirable. This prevents feed from being blown away, keeps out birds, chickens, and rats, and protects against water damage. It is generally advisable to have slides or runners under the feeder and to place it on a feeding floor or platform.



This is a small single-trough self-feeder suitable for six to eight pigs from weaning to maturity. It is also a good feeder for supplements.

Use of the self-feeder. The self-feeder is used for feeding the basal concentrate, such as corn, the protein-rich supplement, the mineral supplement, or the roughage such as alfalfa meal or hay. If the free-choice system is used, separate feeders or compartments are used for each feed making up the ration. The following modifications of the free-choice idea are commonly used with a plan of dry-lot feeding for growing and fattening pigs: (1) self-fed corn; (2) self-fed supplemental mixture of 40 pounds meat and bone scraps, 40 pounds soybean oil meal, 10 pounds cottonseed meal, 10 pounds alfalfa meal; (3) self-fed mineral mixture. This plan outline calls for three feeders or compartments of feeders. A further discussion of the use and value of the self-feeders is given under feeding of growing and fattening pigs and brood-sow feeding.

Trough space for hogs. The size of the hogs determines the trough space to allow per hog at the self-feeder. A space 16 inches wide is ample for a pig until he is finished for market. Small pigs require much less trough space, but it is best to plan on the maximum allowance per pig when planning a feeder. A



This is a double self-feeder for hogs. This feeder is usually made six feet long.

large feeder is illustrated on page 403. Large feeders will accommodate a larger number of pigs per foot of trough room than a feeder of smaller size. From three to five pigs can be fed per self-feeder space or opening. If self-feeding the supplement separately, from 15 to 25 per cent of the spaces are needed for it. For every 16 pigs allow three spaces for basal feed and one for supplement. One feeder space will take care of 30 pigs for mineral feeding. As would be expected, fewer spaces are required by smaller pigs or on pasture.

Floors essential with feeders. When self-feeders are not placed on platforms of either concrete or planks, mud holes

soon appear around the feeders in wet weather. This causes the loss of much feed as there is more or less spillage from all self-feeders. Even large feeders adapted to pasture use should be on platforms unless situated on well-drained, high ground and in use during dry seasons.

Construction of self-feeders. In building the self-feeders for swine some features of construction need to be thoroughly understood; there follows a discussion of the essentials for the construction of the self-feeders.

The runners or skids really provide the foundation for this self-feeder. The runners herewith shown are made of 2×4 material; however, 4×4 runners may be used if necessary. The latter have the advantage of giving greater substantiality and durability to the feeder. Such woods as fir or cypress are preferred because of their lasting qualities. The two-inch material is preferred in order to keep the feeder trough close to the ground, and it is especially adapted if this feeder is to be used on a concrete platform or under cover where conditions conducive to decay are not so unfavorable as on the ground outdoors. Some may prefer to shoe the runners with steel about as thick as an ordinary wagon tire, but this is quite expensive and hardly worth the additional cost; the steel runners may be advisable if the self-feeder is moved often.

Two-inch floors are desirable in all of the self-feeders, this being especially true of the bottom of the trough; one-inch material does not stand the wear and tear of ordinary usage. Matched flooring, which is tight and rainproof, may be desirable if secured in sufficient thickness.

In the feeders the floors should be laid crosswise of the runners as shown. The floors should be snug and tight, as otherwise the grain will sift to the ground and thus waste or lodge in cracks to produce decay of the floor. Use well-seasoned lumber so that the shrinkage later will not produce these undesirable feed-losing cracks.

Framing. The design submitted is of a very substantial frame, made of 2×4 material for the main skeleton, with 1×4 tie pieces. With a feeder built and adjusted as this one, it is quite advisable that the frame be very rigid and strong so that

the trough sides and feed bins will not warp out of shape, and thus encourage the dissipation of feed through wastage; likewise any distortions resulting indirectly from weak framing make the adjustable slides or gates work with difficulty and thus decrease efficiency.

Wind braces may be diagonally placed in the roof from the point of the corn bin to the opposite lower corner. These are placed on the side opposite the feed door, and thus they add to the general rigidity of the structure.

Siding and roof. The self-feeder may be covered with matched flooring or drop-siding most successfully, inasmuch as this is very tight and quite suitable to a granary, which is, in reality, the body portion of this feeder. The ordinary ten-inch shiplap, if tight, is satisfactory.

A durable, reliable grade of prepared roofing may be used to cover either the matched flooring or the shiplap used, in order to insure protection to the housed grain; this is quite advisable.

Feeding trough in self-feeder. The trough deserves much attention, especially as regards size and general dimensions. An ill-proportioned trough is unsatisfactory because it is not adaptable to the conformation of swine, thus causing them to waste feed, not only by rooting it from the trough, but by putting their feet into it. In addition, a trough must be made so that it will work well in conjunction with the feed supply space.

The trough has a vertical opening of practically 24 inches, this being found satisfactory for all classes of swine of ordinary size. The compartment is practically ten-inches wide when measured from the outer trough surface to the adjustable slide, but the inside measurements are exactly eight inches on the floor of the trough with the adjustable feed control or sliding gate down. These measurements should not deviate much from those given if best results are to be expected.

The trough in the self-feeder is so built as to furnish much protection from rain, the side of the feeder being extended downward on a vertical line with the front of the trough so as to allow only a two-foot trough opening. The rain, therefore, that beats upon the side of this feeder above the trough proper simply drips down without getting into the feed compartment—

unless, of course, the wind is very strong and from the right direction to blow the drippings into it.

A feed accelerator is so arranged as to encourage and permit the feed to enter the trough at the inward lower side, just at the base of the feed control gate. If this incline is made too steep, the feed will clog at the throat opening; if it is not made steep enough, some of the slower-moving, more compact grains will not flow freely. This inclined feed accelerator is best covered with smooth, well-planed lumber so as to lessen the friction of the feed passing over it; the smoother the lumber, other things being equal, the less the pitch necessary.

Feed-control gates. This gate or adjustable slide for controlling the amount of feed entering the trough indirectly through making the capacity of the opening or throat larger or smaller, as the case may be, should be made of hardwood, preferably oak, that will not warp or be flexible. The bottom of the dividing slide, beveled, should be toward the inner side in order to facilitate the closing adjustment. In case of softwood-slide construction, it may be advisable to reinforce the lower edge with a mortised steel strip.

The width of the slide is one inch, for ease of adjustment; this does not lessen the horizontal feed-trough space.

It is to be noticed that the adjustable slide works up and down in between the granary wall proper and the horizontal iron pipe rod of the feed guard. This causes it to be very snug and substantial.

The adjustable gate is manipulated simply by loosening or *tightening the end nuts of the control slide*. The slide is moved upward or downward by means of the hands. Sometimes it may be necessary to use a bar to pry the slide or gate up, but an ordinary hammer may be used to drive it down.

Feed guards. To discourage feed wastage, the guard is very essential. It can be made easily and is greatly to be desired in comparison with the ordinary wooden kind, inasmuch as the length of service is much greater and the satisfaction of use is more pronounced.

This guard has the following advantages: It prevents the hogs from rooting out the grain; it encourages each hog to eat in his

own separate compartment; it discourages the placing of feet into the trough; it prevents fighting to some extent, inasmuch as the hog eating at his own compartment is not bothered by the others; and it furnishes excellent support to the adjustable slide, as well as a durable cover for the front of the trough.

Automatic trough cover. To protect the grain from the weather, and to discourage animals, other than swine, from entering the feed compartment, as well as to encourage the pigs themselves to eat the feed without wasting, this automatic trough cover has been devised. It should be made of good heavy sheet iron, preferably 18 gauge, in order to prevent bending. This cover is reinforced at the top and at the bottom with cross bars which tend to hold it substantially together as well as to give it weight and rigidity.

On a six-foot feeder, the trough cover should be divided into two sections in order to prevent its being drawn out of shape, which would necessarily follow if the pigs at one end of the feeder would have to open simply one curtain for the entire feed trough. The stress would be so great in this case that it would be likely to bend the cover. It is really desirable to make it not more than a foot and a half wide in many instances; but it is shown in a 2' 8" width. The back supports should be substantial and strong, since they must stand much wear and tear.

This cover is entirely optional and should be considered as such. The hog may learn to root up the cover and get at the feeds inside. When used it should be hinged on the inner portion of the trough, and should have an incline similar to that shown for the feed guards.

Painting. The expense of painting the wooden self-feeder should prove a good investment, as it prolongs the life of the structure and adds greatly to its appearance. Any reliable outside paint will be satisfactory, two coats being given to insure that the wood be thoroughly covered.

Types of feeders described. Just a few of the many types of self-feeders are herein described in detail. Many modifications of these types have also served well in the swine-feeding pastures and lots of the country. In various communities dif-

ferent kinds predominate. Illustrations are included of many of the common kinds.

The single-trough self-feeder. The single-trough feeder is of rather small size. It is adapted for feeding all sorts of concentrates and also feed mixtures which have a uniform mix and do not separate. Divisions may be put in this feeder so as to make compartments. It may be built double; that is, with a trough on each side. It is especially well suited for a supplement feeder, for both proteins and minerals. Many changes in this type are possible as regards size, material, and design. As it clogs at the outlet, some sort of agitator is needed for some feeds. A loose chain, or wires extended down from the feed hopper to the trough and fastened at either end, will do the trick, as the hogs feeding will move them above and agitate the feed. An automatic trough cover can be made for this feeder.

Large-size self-feeders. On page 403 is shown a large-size self-feeder. When built 18-feet long it will hold 200 bushels of corn. It may be built short if so desired. Partitions in the feeder will permit the feeding of different feeds. A section is commonly used for supplement in practice. This feeder will hold about a month's supply of feed for 100 pigs. When ground feed is put in the feeder there may be some clogging. This is avoided by hanging chains from the top down through the throat into the feed trough.

Commercial self-feeders. There are many good commercial self-feeders on the market. Some of these have features which are very valuable and difficult to provide on a home-made feeder. One should make certain as to the durability, the reliability of operation, the adaptability for the need, and the protection provided the feed. If it is a time-tried feeder and it meets the requirements, the matter of cost should be the deciding factor.

Feeding floors. There are many different kinds of feeding floors. Simplicity of design is an important point in determining the kind; for a well-built, simple floor is usually more durable than a more complex structure. Feeding floors are sometimes built of materials other than concrete. Wood floors, although the lumber may be cheap, are seldom economical, for they are

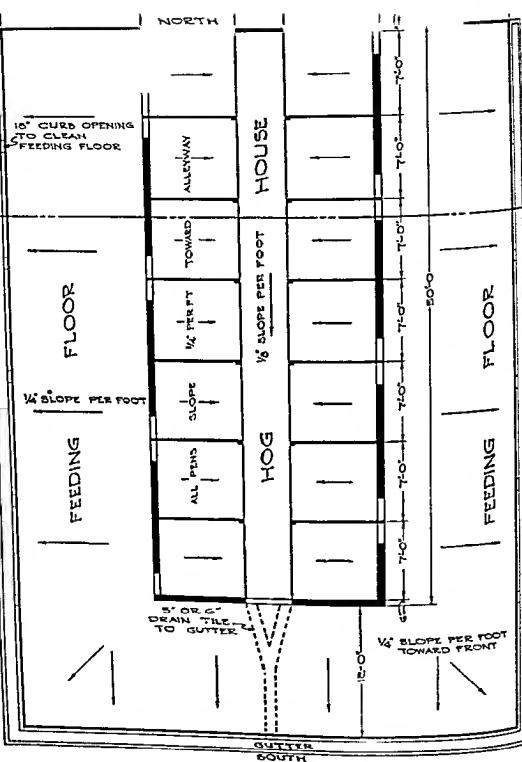
TABLE 56. BILL OF MATERIAL FOR LARGE-SIZE SELF-FEEDER

ITEM	GRADE	PIECES	SIZE	LENGTH	QUAN- TITY
Skids.....	1 Com.	4	4" x 4"	18'0"	
Flooring.....	Rgh.	23	2" x 10"	8'0"	
Plates.....	2 Com.	2	2" x 4"	18'0"	
Ridge board.....	2 Com.	1	2" x 6"	18'0"	
Nailers.....	2 Com.	6	2" x 4"	18'0"	
Posts.....	2 Com.	1	2" x 4"	12'0"	
Wall braces.....	2 Com.	2	2" x 4"	18'0"	
Rafters.....	2 Com.	3	2" x 4"	18'0"	
Rafters.....	2 Com.	1	2" x 4"	10'0"	
Feed stop.....	2 Com.	2	2" x 4"	18'0"	
Feed divider ridge.....	2 Com.	2	1" x 6"	18'0"	
Feed shut-off.....	2 Com.	2	1" x 8"	18'0"	
Nailing strip.....	2 Com.	2	1" x 8"	18'0"	
Partitions.....	2 Com.	2	1" x 12"	16'0"	
Car siding (doors).....	2 Com.	5	1" x 6"	10'0"	
Car siding (ends).....	2 Com.	24	1" x 6"	10'0"	
Car siding (roof).....	2 Com.	20	1" x 6"	10'0"	
Walls (flooring).....	T and G	12	1" x 6"	14'0"	
Reinforcing rod.....			1½" x 4'6"		2
Hinges.....			4" T		6
Barn latches.....					2
Carriage bolts.....			1½" x 5"		6
Wing nuts.....			1½"		6
Towing clevis.....			3'6" x 1½" x 18"		4
Bolts.....			1½" x 6"		8
Nails as needed.....					

rately waterproof, are often slippery when wet, and are unsanitary. Rat-proof construction is impossible with a wood floor; in fact, rat-breeding places are increased by building of wood floors. Concrete floors are easily built and are prerequisites to successful swine feeding, as most types of soils become unsanitary and muddy from hog feeding.

Saving effected by a feeding floor. The feeding of corn or other grains on a bare ground in the hog lot is not only unsanitary but also uneconomical. It is usually noted that the pigs with the concrete feeding floor make slightly faster gains and require a little less corn to make a unit of gain.

Feeding floors are not so adapted to field feeding, as indicated in the McLean County system, because of the rotation of the



This is a central hog house and concrete feeding floor layout.



Here the feeding floor adjoins the hog house. Note the equipment, self-feeder, and hog waterer.

hog pasture. The floor equipment serves best as a place for feeding fattening shotes or for brood sows in winter.

Locating the feeding floor. Care should be taken in choosing a location for the feeding floor. The main floor should be at the center of the swine-feeding operation. The corner-crib is almost always located near the hog barn, and it would be ideal to have the feeding floor adjoining the crib and the hog barn. It is preferable to have the floor on the south side, or perhaps the east side, of the feed building, granary, or crib so protection from wind, rain, and snow is given the adjoining feeding floor. In case such a location is not feasible and the floor is exposed, it may be advisable to build a solid wood fence to give protection. Convenience, time, labor, feed supply, and hog house are the main points bearing upon feeding-floor locations.

Construction. Concrete feeding floors should be made not less than four-inches thick. What is known as one-course construction, which means the same mixture throughout, should be used. Mix materials rather dry. Then add water, using $4\frac{1}{4}$ to $5\frac{1}{2}$ gallons for each sack of cement, depending on moisture of sand and gravel.

The floor should be sloped in at least one direction so it will drain quickly after rains. A slope of one-fourth inch to the foot is enough. The forms, usually two-by-four pieces, are care-

fully set on edge in such position that they give the proper slope to the floor when concrete is struck off with a straightedge. Slabs should be about ten-feet square, and the joints between them should extend clear through to the subgrade. Finishing should be done with a wood float, rather than with a steel trowel, so that the even gritty surface thus obtained will prevent slipperiness in all seasons of the year and provide a good substantial foothold for the animals.

A curb or apron like that shown will prevent hogs from pushing grain off when feeding. This curb or apron should extend 12 inches below ground level to prevent hogs from rooting underneath the floor.

A few hours after the concrete has been finished, the work must be protected by a covering of moist earth or similar material kept wet by sprinkling for about a week. Then the covering may be removed and the floor put into use. Wagons should not be driven over it, however, until it is at least three weeks old.

Frequently there is no time to build a feeding floor until after silo-filling, and this may make it necessary to do some of the concrete work after cold weather sets in. The floor can be put in even though the nights are frosty, provided a covering of sacks or a heavy layer of straw is laid over the concrete to keep it from freezing.

Size of floor to build. Hogs weighing between 100 and 200 pounds need from five to ten square feet for each animal. This avoids overcrowding. It allows the smaller or weaker pigs to thrive, which is often not the case when feeding floors are too small. If the pigs are to be confined to the concrete entirely, more space would be required. An average of 12 square feet would be an ample allowance per hog.

The table on page 409 is helpful in determining the size of floor required for different numbers of hogs. It also gives an estimate of the amount of cement, sand, and gravel needed, based on a 1:2:3 mixture, four-inches thick.

Mixing the materials. Concrete may be mixed either by machine or by hand. Machine mixing is to be preferred as in this way thorough mixing is easier to obtain and all batches will be uniform. However, first-class concrete can be mixed by hand.

TABLE 57. SIZE OF FLOOR REQUIRED FOR DIFFERENT NUMBERS OF Hogs

NUMBER OF HOGS	SQUARE FEET OF FLOOR	SACKS OF CEMENT	CUBIC YARDS OF SAND	CUBIC YARDS OF GRAVEL
15	150	13	1	1½
30	300	26	2	3
60	600	52	4	6
90	900	77	5¾	8¾
120	1200	103	7¾	11¾
150	1500	128	9½	14½

Mixing should continue until every pebble or stone is completely coated with a thoroughly mixed mortar of sand and cement.

Machine mixing. Practically all of the standard batch-type of machine mixers on the market render satisfactory service and more thoroughly mix concrete. In case one person may not have sufficient work to justify the purchase of a mixer it is often possible to get several neighbors to share the expense of buying a machine which all may use. Mixing should continue for one or two minutes after all materials, including water, are placed in the mixer drum. On the completion of a job or of a day's work the mixing drum should be thoroughly cleaned. This is best done by scouring with water and gravel.

The correct proportions of water, cement, sand, and gravel to use in the mixture are governed by the character of the work for which the concrete is intended. Until the discovery of the law that there is a direct relation between the strength of concrete and the amount of water used per sack of cement, it was customary to specify mixtures as one part cement to a certain number of parts of sand and pebbles or crushed rock. In modern practice the quantity of mixing water is specified according to the class of work for which concrete is to be used.

In a concrete mixture, cement and water form a paste which, upon hardening, acts as a binder to hold the particles of sand and gravel together into a permanent mass. The use of too much mixing water thins or dilutes the paste, weakening its cementing properties. Consequently it is important that the proper pro-

portions of cement and water be used for best results, the exact proportions depending upon the work.

Hand mixing. A watertight platform at least 7-feet wide and 12-feet long should be provided. This is large enough to permit two men to use shovels and to work at one time. Such a platform should preferably be made of boards one or two inches thick, tongued and grooved so that joints are tight and the platform rigid. These planks may be nailed to three or more two-by-four strips set on edge. Two sides and one end of the platform should have a strip nailed along the edge and projecting two inches above the mixing surface of the platform to prevent materials from being washed or shoveled off while mixing.

The usual procedure in mixing concrete by hand is as follows:

The measured quantity of sand is spread out evenly on the platform. On this the required amount of cement is evenly distributed. The cement and sand are then turned over thoroughly with square-pointed shovels enough times to produce a mass of uniform color, free from streaks of brown and gray.

This mixture is next spread out evenly over the platform and then the required quantity of gravel or broken stone is measured and spread in a layer on top. The materials are again mixed by turning with shovels until the gravel has been uniformly distributed throughout the mixture of sand and cement. At least three turnings are necessary.

A depression or hollow is then formed in the center of the pile and the proper amount of water is added slowly while the materials are turned in towards the center with square-pointed shovels, this turning being continued until the cement, sand, and gravel have been thoroughly and uniformly combined and the desired workability and smoothness is obtained throughout the mixture.

Placing concrete. Concrete should be placed in the forms as soon as possible, in no case more than 45 minutes after mixing. It should be deposited in layers of uniform depth, usually not exceeding six inches. When placed in the forms it should be tamped and spaded so as to cause it to settle thoroughly and produce a dense mass. By "spading" is meant the working of a



This is a U-shaped hog trough in use.

spade or chisel-edge board in the concrete and between it and the side of the forms, moving the spading tool to and fro and up and down. This working of the concrete next to the forms forces the large particles away from the form face into the mass of the concrete and insures an even, dense surface when forms are removed.

Finishing concrete. The surface of a floor or walk should be finished by using a wood float. A metal trowel should be used sparingly, if at all, because its use brings a film of fine material to the surface, which lacks the wearing quality of the cement and sand combined and may cause the surface to develop "hair cracks" after the concrete hardens. A trowelled surface is smoother, but does not wear so well as a floated surface and is likely to be slippery.

Protecting and curing newly placed concrete. If concrete is left exposed to sun and wind before it has hardened properly, much of the water necessary to hardening will evaporate and the concrete will simply dry out. Moisture is necessary to the proper hardening of concrete because, as already mentioned, this process is due to changes which take place in the cement when mixed with the proper amount of water.

Hog troughs. Wooden troughs are very easily constructed and are commonly used for feeding and watering on almost all farms. Two-inch wood is best for hog troughs, especially if the length is to accommodate several hogs.

The V-shape trough is simple to build. Good substantial material is needed and in addition to the two planks forming the V, two ends of the same, cut rather long to prevent upsetting, complete the job. Cross pieces over the top may be added, and



This is a substantial plank V-type hog trough.

are needed to give strength to long troughs. Although the V-trough is the most common, U-shaped troughs (page 410) are easily constructed and are now very widely used.

Hog waterers. It has been estimated the approximate water consumption daily by a 100-pound spring pig to be 9 pounds, while a fall pig of the same weight requires 7.5 pounds; that is, when freewill drinking is allowed. The allowance will range from $\frac{1}{2}$ to $1\frac{1}{2}$ gallons per 100 pounds of live weight. For 10 pigs an automatic waterer of 25-gallon capacity would be needed in summer and one of about 15-gallon capacity in winter. One automatic cup will serve 20 pigs. This amount of water is, of course, markedly altered by circumstances, as well as kinds and amount of feed consumed. The amount needed depends upon the size of the pigs, the feeds, and the environment. Brood sows when suckling pigs, like dairy cows, have a high water requirement.

Feeds influence water consumption. Feeds vary in their moisture content. Grains contain from 15 to 20 per cent, while skim milk contains 90 per cent. Feeding in slop form affects the amount of water used. Laxative feeds, high in mineral or fiber content, have a tendency to increase the consumption of water.

Atmospheric conditions influence water consumed. A dry atmosphere—that is, one with low moisture or humidity—increases water consumption merely because evaporation is greater and the animal drinks more in order to keep up the water balance. The more an animal eats, the greater will be the demand for water.

Temperature is also one of the factors in the need for water.

High temperature increases the water evaporation from the body and causes an increased intake.

Freewill watering. It is quite generally agreed that in watering swine of all classes the practice to be preferred is freewill watering. The consumption is a reliable index of the body needs. Watering in troughs requires much work. If the trough is allowed to become empty, as often is the case, the freewill plan is not carried out. At the Minnesota Station, pigs fed from 83 to 203 pounds on rape pasture and allowed free access to an automatic waterer drank 638 pounds of water per 100 pounds gain. A comparable lot watered three times daily drank 500 pounds of water for the same gain. No significant difference in rate of gain or feed requirement was demonstrated.

Equipment for watering. Many means are used to provide water to swine, and usually the objective is a constant supply of fresh, clean water. A creek, pond, or tile drain will serve well if the water is free from contamination.

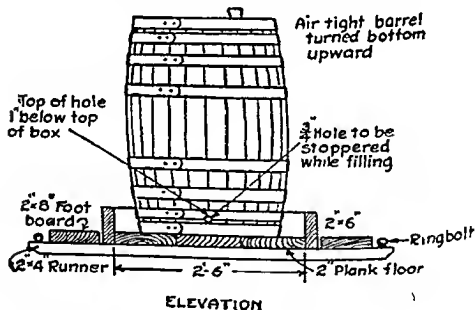
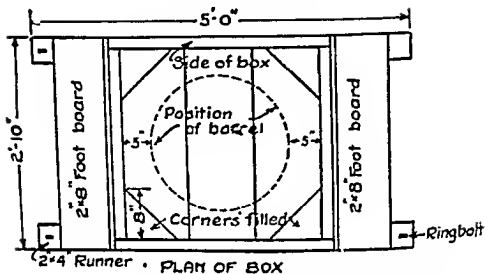
Many modifications of the original watertrough have appeared, all more or less automatic in operation. Some attach to a water tank or storage barrel or container, while others are joined directly to a pipeline of a pressure system.

A simple barrel hog waterer. The illustration on page 414 shows a simple waterer that can be easily made. The planks are fitted together so as to form a box or trough, in which the barrel is placed. This trough is usually made square and of such size that there will be a five-inch drinking space between the barrel and the sides of the trough. The trough corners are filled so that the pigs cannot lie in them. Sometimes the trough is made of concrete. A circular trough can then be readily constructed by making the trough forms out of sheet iron.

The barrel used for this purpose must be airtight or the trough will lie flooded. A hole is bored in the barrel about three inches from the bottom, which forms an outlet for the water supply in the barrel to the drinking trough. This hole is left open at all times except when the barrel is being filled, when it should be tightly stoppered. This is therefore an automatic waterer, and is practically foolproof if the barrel is kept tight.

In the top of the barrel is a hole for filling. The barrel must

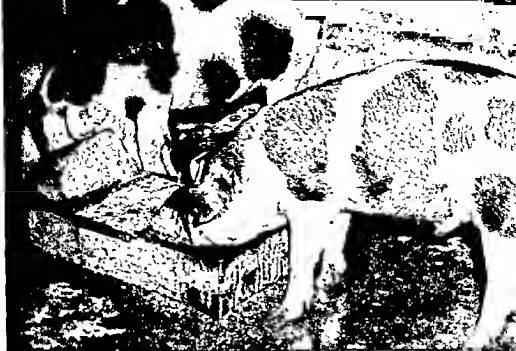
BARREL HOG WATERER



This is a barrel hog waterer.

be filled to running over when this hole is closed. The plug must be inserted in the water entrance inlet before the stopper is taken from the water-feed hole.

Commercial barrel waterers. These are available at small cost and are satisfactory for watering. They may be attached to



Handy watering equipment not only saves labor but also provides a constant supply for the pigs.

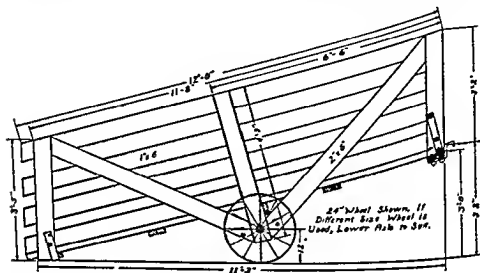
a wooden barrel or steel drum in freezing weather. Because of the limited capacity, frequent fillings are necessary. This may be overcome by using several barrels to water a large group of pigs.

Pressure-system waterers. Rather few of the home-made kinds are in use, but several commercial waterers of this type are offered for sale. These are equipped with lamps or other heaters to prevent freezing. The cost of these waterers is not great, but the cost of installing is greater because of the depth of the pipeline. This restricts their use to the more permanent hog lots or to single installations in winter feeding yards.

Watering hogs on the clean-ground plan. This is one of the most perplexing problems in the clean-ground plan. It has been solved in many ways. Temporary pipelines, shallow wells, tapped tile drains, and large water tanks are some of the possible solutions.

Simple portable hog-loading chute. Illustrated on page 416 is a hog-loading chute simple in construction. It is very satisfactory for farm use and can be constructed with a low cost for materials and labor. Changing the position of the wheels is not necessary for moving. A gate may be included if desired.

Hog wallows. A sanitary hog wallow can be constructed with but very little cost. It adds to the comfort of the hogs. During warm summer weather a feed saving may be effected by the use of a wallow. The greatest objection is that the use of a cement hog wallow does not work into the clean-ground plan of hog



This is a simple, substantial, movable hog-loading chute.

growing. Wallows may be varied in size to suit the size of the herd. The depth may be from 12 to 18 inches. Watertight construction with a rich mixture is essential. A foundation, although not necessary, usually adds to the permanence of the wallow by preventing cracking of the floor. A drain should also be provided. The floor, which is made of five-inch reinforced concrete, should be pitched toward the drain about one inch to four feet. The side walls are made continuous with the foundation and about six inches in width. They should be safeguarded against breaks and cracking by using suitable reinforcing.

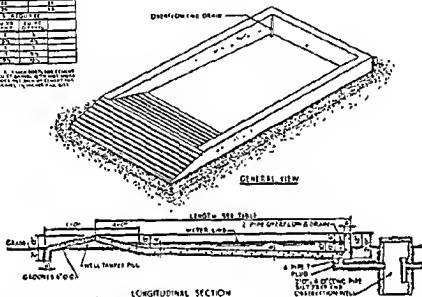
The value of a hog wallow. Very few experiments have been conducted on the value of hog wallows. No doubt, the results from the use of the wallow would be determined very largely by its adding to the comfort of the pigs. In warm climates this may be quite great.

In a trial at the Texas Station, the concrete wallow and floor

made a very creditable showing mainly because of greater feed consumption. An earth wallow freshly made appeared to be as effective as an artificial wallow in a Louisiana trial. A saving of feed and increased gain were effected. In a 90-day test pigs that had access to a concrete hog wallow made an average gain of 14

SIZE OF HOG WALLOW REQUIRED			
NO. OF PIGS IN WALL	NO. OF PIGS	AREA OF WALL	AREA OF WALL
10	10	10	10
20	20	20	20
30	30	30	30
40	40	40	40
50	50	50	50
60	60	60	60
70	70	70	70
80	80	80	80
90	90	90	90
100	100	100	100

NOTE: The above table is a guide only and should not be used as a basis for determining the size of the wallow. The size of the wallow should be determined by the number of pigs in the wallow and the size of the wallow.



Iowa State College, Bulletin P 70

This is a concrete hog wallow. Plans show how to construct it and what materials are required.

pounds more per head and required 10 pounds less feed to make 100 pounds gain than pigs without the wallow. The concrete feeding floor, however, had no appreciable effect upon rate or economy of the swine gains.

Sun shades for hogs. A good shade adds to the comfort of hogs in warm weather. Movable houses with sides that may be opened out serve very well for this purpose (see page 420). Temporary shade may be built with little labor and cost. Wooden fence posts set in the ground supporting a temporary roof will provide ample shade. Woven fence wire is sometimes used over the



Portland Cement Association

Here is a concrete hog wallow in use.

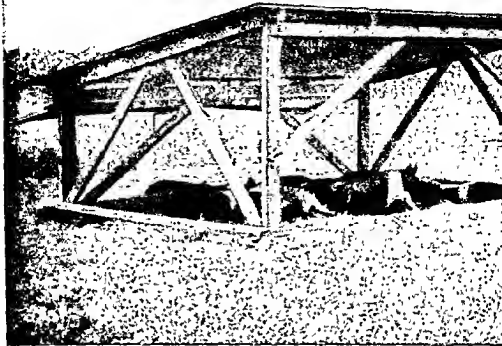
cause they may be moved. A vat is a convenience in ridding a herd of hogs of lice and mange. These troubles are widespread

framework built on top of the posts and the wire covered with fresh-cut hay or similar material.

Dipping vats. Dipping vats may be constructed on the farm; where a number of hogs are raised, it may be economical to build one. Metal troughs are available and have an advantage be-

TABLE 58. BILL OF MATERIALS FOR AN ELECTRIC PIG BROODER

UNITS	SIZE	SIZE OF STOCK MATERIALS	Use
1 piece	1" x 12" x 36"	1-1" x 12" x 6'	Brooder size
1 piece	1" x 12" x 35 $\frac{1}{4}$ "		
2 pieces	1" x 4" x 51"	1-1" x 4" x 9'	Braces
1 piece	1" x 8" x 51"		
1 piece	1" x 8" x 39"	1-1" x 8" x 12'	Top of brooder
1 piece	1" x 8" x 27"	shiplap	
1 piece	1" x 8" x 15"		
2 pieces	1" x 2" x 36"	1" x 2" x 8'	Braces for brooder
1 piece	1" x 2" x 51"		top
2 pieces	1" x 6" x 51"	1" x 4" x 9'	Guard rail
3 pieces	1" x 4" x 20"	1" x 4" x 5'	Guard rail cleats
1 piece	16" x 16" hardware cloth, $\frac{1}{2}$ " mesh		
1	14" RLM reflector enameled or deep aluminum cake pan		
1	100 watt or 150 watt lamp		
1	weatherproof socket		
1	10' rubber-covered extension cord		
1	Rubber plug or cap		
Nails $\frac{1}{2}$ lb. of 8d and 6d common nails and $\frac{1}{4}$ lb. of small wire staples			



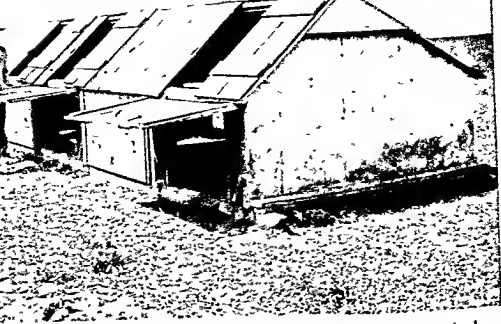
This picture shows a portable sunshade in use.

and are factors in profitable swine raising. Hogs infected with lice or mange make rather slow, costly gains and very often sell at a discount on the market. Total immersion of the animal gives the most satisfactory results in severe cases and a dipping vat excels all other devices for thoroughly applying the remedial solution.

Location of a dipping vat. Often the dipping vat is placed in the alleyway or a special pen provided for it in the hog house, but it is most often out-of-doors. Suggestions helpful in the determination of the location are listed: (a) It should be readily accessible from the hog house and yards. (b) It should be provided with drainage away from the pit so as to carry away storm water and to provide dry surroundings. (c) It is best situated in the open sunshine, thus assisting in securing dry and sanitary conditions about the vat.

Pig brooder building. Not much material or time is needed to build an electric pig brooder. However, it should be built properly and be made of good material. Details for constructing an electric brooder are shown on page 421. The bill of materials is shown in the table on page 418.

Hand hurdle or herder. To be of the most use a hurdle should be light in weight and rather small in size so that it may



This movable house has the doors opened. They serve as a sunshade.

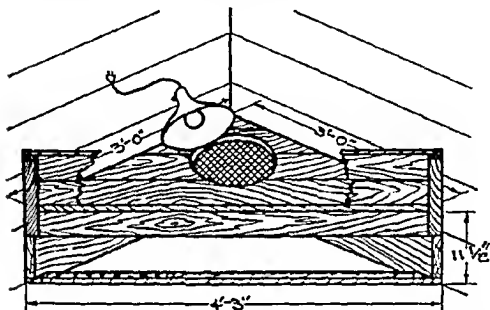
be handled readily. Many kinds of hurdles are made and these are easily constructed. They are of great value around the hog house on the farm for such things as sorting hogs in a lane or driveway and for driving a brood sow or a boar. At least one hand hurdle should accompany the breed herd to the show. The usual construction is a frame with crosspieces. For handling of boars, as at a show, a smaller, solid hurdle about two-feet square is preferred.

The breeding crate. Many manufactured breeding crates are on the market. Some are very complex in design and mechanism. A very satisfactory, simple breeding crate may be built in the farm workshop. The purpose of the breeding crate is to facilitate the breeding of a large boar to a gilt or a young boar to a large sow.

The combination crate. A holding crate has many uses on the hog farm. Such a crate is usable for holding hogs for ringing, bleeding, vaccinating, ear tagging and other purposes. A combination breeding and holding crate is shown on page 423. A holding crate in operation is shown on page 424.

Hog crates. One or more hog shipping crates are a great convenience around the hog farm. Their greatest use, however, is in the shipping of breeding hogs. Poorly constructed crates are often used with the result of injury to the hogs. However, per-

haps the most common error in using crates for shipment is in regard to the size used. Damage to the pigs is quite likely to result if the crate is too small or too large. A crate can be built in a short time. It should offer ample protection and be of proper



This is a plan for the construction of an electric pig brooder. A 150-watt bulb is used for early farrowing and a 100-watt bulb for later farrowing.

size. Most crates are used for express shipments. Weight, therefore, should be kept at a *minimum*.

Building the hog crate. With a handsaw, a hammer, a square and a pencil, lumber and nails, and a box for a sawhorse, you are prepared to build a livestock shipping crate (see page 425). The dimensions and materials, and use are given:

For hogs 100-225 pounds weight

Inside width, 1'6"

Inside height, 2'9"

Inside length, 4'4"

Weight of crate, 80 lbs.

SWINE MANAGEMENT

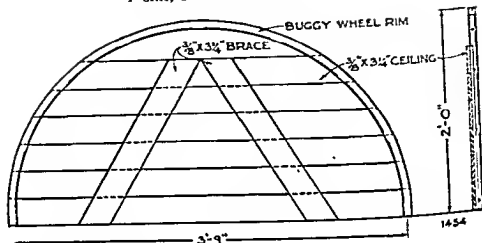
Material needed

Ends

4 slats, 1" x 4" x 1'10"

1 slat, 1" x 6" x 1'10"

1 slat, 1" x 3" x 1'10"



This is a hand hurdle for swine.

Sides

6 uprights, 1" x 4" x 3'10"

6 slats, 1" x 4" x 4'4"

2 slats, 1" x 6" x 4'4"

Floor

2 skids, 2" x 2" x 4'4"

Flooring, in 20" lengths

Top

4 slats, 1" x 4" x 1'8"

1 slat, 1" x 4" x 1'10"

End gate

1 2"-strip, 1'10" long

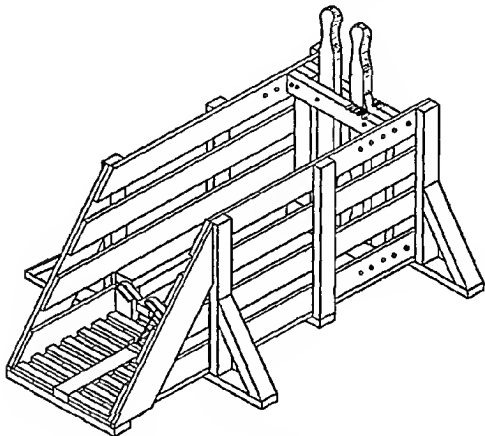
2 boards, 1" x 6" x 2'11"

1 piece, 1" x 4" x 12"

1. *The floor.* Cut a piece of two-by-four to a length of 4 feet 4 inches. Then rip to make the two skids. Cut the floor boards 20-inches long. Nail the floor boards to the skids with two or three 7-penny nails in the ends of each board.

It is well to leave cracks from $\frac{1}{4}$ - to $\frac{3}{8}$ -inches wide between the floor boards. This allows for the shrinking and swelling which accompanies weather changes and wetting and drying.

2. *The sides.* The bottom board is of 6-inch width. The rest of the slats on the crate are 4-inch width. Cut three uprights for



This is a combination breeding and holding crate.

each side, each 3-feet long, and lay them on the ground. In placing the slats on the uprights the top slat is nailed even with the ends of the uprights. Measure the thickness of the floor plus the skid and place the bottom slat this distance from the other end of the upright. This will make the bottom slat rest on the floor when the crate is assembled. The second slat is nailed on 1 inch above the bottom slat. Sixteen inches from the floor, nail the



Here we see a holding crate in operation.

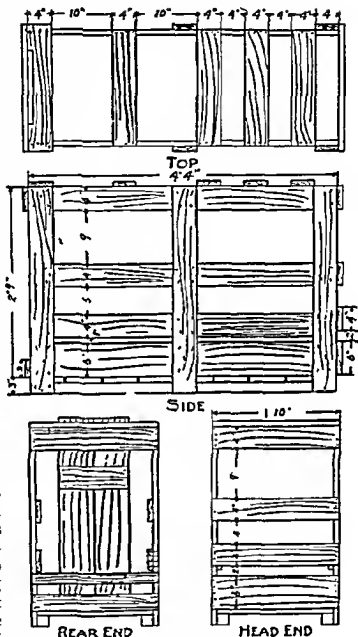
third slat. Four 6- or 7-penny nails where the slats and the up-rights cross one another give good strength to the side. The nails should be long enough to go through and clinch well on the outside of the crate.

3. Floor and sides together. The lower ends of the up-rights are next nailed to the skids with three to five nails each. Remember that the slats are on the inside of the up-rights.

4. Ends and top. One bottom board 3-inches wide and another bottom board 6-inches wide are now cut 1 foot 10 inches long. There are five 4-inch slats of the same length—three for the closed end, one for the top at the gate end, and one above the gate. These slats are now nailed in place. The spacing of slats at the front end corresponds to the spacing of the side slats, except that the second slat is two inches above the bottom slat to allow ample breathing space for the hog.

Four cross-pieces for the top are 20 inches in length and are spaced 4 inches apart on the front half of the crate and 10 inches on the rear half.

5. *Construction of end gate.* Two 6-inch boards 2 feet 11 inches long, nailed together with a 2-inch cleat, form the door on the open end of the hog crate. The cleat is 1 foot 10 inches long, nailed on the outside of the door, and is placed so that it rests 2 inches above the bottom board. Also nail a 1" \times 4" \times 12" piece 1 foot 3 inches above the cleat to hold the top of the door together.



Wisconsin Circular 153

This is a working plan for the hog crate.

The gate uprights fit into a notch cut in the top crosspiece. The inside dimensions for hog shipping crates of various sizes:

SWINE MANAGEMENT

For pigs up to 100 pounds weight
Width, inside, 1'0"
Height, inside, 2'0"
Length of floor, 3'10"

For pigs 225 to 500 pounds weight
Width, inside, 2'0"
Height, inside, 3'4"
Length of floor, 6'6"

For aged animals 600 to 800 pounds weight, approximate
Width, inside, 2'2"
Height, inside, 4'0"
Length of floor, 7'0"

Fence and fencing. Another of the important equipment features is the matter of fencing. Good fences are a necessity. Farms on which large numbers of hogs are raised and upon which the McLean County system is practiced need hog-tight fences for all of the tillable acres so that the hog pasture may be worked into the rotation.

Advantages of good fences on hog farms. 1. Hogs may be separated into suitable groups of about the same size and fed for the same purpose.

2. Pasture crops may be utilized. This brings about many benefits: Protein feeds are saved; healthful conditions prevail; rations are less likely to be deficient; and gains are more rapid and economical.

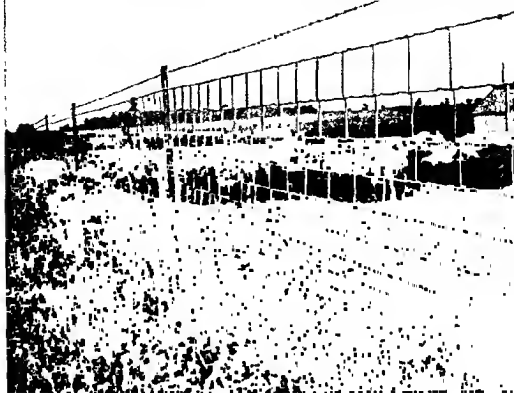
3. By confining the hogs to one area and distributing the self-feeders or places of feeding, manure is spread more uniformly over the land.

4. Crops may be hogged down, such as corn, or in the cases of artichokes and sweet potatoes they may be "hogged up."

5. Fenced fields permit the rotation of crops and also of pasturage so essential in disease and parasite control.

6. Fences prevent the damaging of crops by keeping the hogs out of the cropfields while they are growing and maturing.

7. Livestock of various classes may be separated. Sheep and



Keystone Steel and Wire Company

Good fences are a necessity in hog raising.

swine cannot be pastured together successfully. This is also true of other farm animals.

8. Crops that have but little value or crops that have been damaged may be used for field feeding of hogs. This is applied in such cases as a crop damaged by hail and a crop having a very low market value.

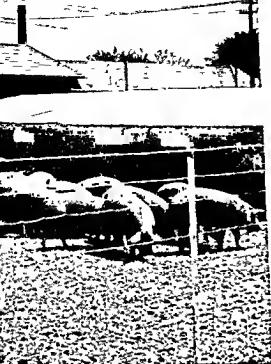
9. With fields well fenced, the aftermath from crops may be used for late summer and fall pasture. The clover or sweet clover growth from seeding in the grain may be used for fall pasturage.

10. It is a marked aid to good herd management. The boar or boars are kept separate; the hogs needing most attention can likewise be kept separate.

11. Hogs are not permitted to get onto the highways or on other persons' property.

12. Hogs may be kept separate from a neighbor's hogs or other animals. The neighbor's boar is often the cause of much difficulty.

The foregoing list but partially covers the advantages re-



Keystone Steel and Wire Company

Woven-wire fence plus top barbed wire is used for swine stock and field fencing.

sulting from properly fencing a hog farm. The farm is also enhanced in appearance as well as in actual value.

Temporary fences. With modern fencing materials a temporary fence may be constructed with little labor. Steel posts may be driven and a woven-wire fence stretched in a very short time. Temporary fences have many uses on the hog farm. Dividing pastures and parts of cornfields for hogging-down are two very common examples of their use.

Kinds of fence. The woven-wire fence is most suitable for hogs. In fact, it is almost universally used for hog lots and pastures. In many cases the woven wire is supplemented with two or three strands of barbed wire on top. Fences of several sizes of wire are obtainable. No. 9 fence wire is very satisfactory and generally used for most hog fences. A fence made with No. 9 top and bottom wires and with No. 11 intermediate bars and stays is also quite satisfactory, but it is not so durable nor so lasting as the first mentioned. The all No. 9 wire fence is preferred around the yards and houses, while the wire with lighter cables and stays is well suited for field use.

Combination fences. When a fence is constructed on a farm, it usually must serve for other classes of livestock as well as for swine. The hog fence is used for the bottom and the fence extended upward to the desired height by the use of barbed wire. The common heights of field hog-fence are 26-inch with seven bars, and 32-inch with eight bars. The adapting of the 32-inch hog fence to field fencing by use of barbed wire is shown on page 427.

Other equipment. There are several other items of equipment which may be worthy of consideration because of their use in the locality. The reference readings should be used for obtaining descriptions and plans of construction for these articles. In Chapters 11 and 16 there is a discussion of such things as ear notchers, hog ringers, etc.

SUGGESTIONS FOR FURTHER STUDY

1. Select a swine farm in your area and make a complete statement of the requirements for housing and equipment.
2. Make a study of various hog houses both central and movable in your area and determine the advantages of the various kind.
3. Make an ideal set-up, housing and equipment, suitable for economical hog production in your area.

REFERENCES

United States Department of Agriculture:

Practical Hog Houses. Farmers' Bulletin, 1487

Hog-Lot Equipment. Farmers' Bulletin, 1490

Hog-Housing Requirements. Circular, 701

Use of Concrete on the Farm. Farmers' Bulletin, 1772

CHAPTER 19

Marketing Hogs

THE HOG raiser is periodically confronted with the problems of when and where the pig crop should be marketed. Since the profit from the enterprise depends upon the income over and above the cost of production, marketing is an important consideration.

When the hogs are marketed is related to production. In making plans for hog raising the successful producer gives thought to when the pigs will be ready for market. A pig crop can be ready for market nine months after the sows are bred. The farm operator who takes advantage of seasonal variations can make greater returns from the hog enterprise. This requires taking into consideration the seasonal variation in hog prices, the demand for hogs of various weights, and the supply of feed. The operator must consider the production costs as well as the probable sale prices in making swine production plans which offer the greatest opportunity for profit.

Where and how to market demand the attention of the hog producer as he wishes to get the greatest income from his pig crop. Marketing costs too are to be considered in choosing a market and comparison made on a net income basis. The most profitable outlet is probably the most urgent need. One packer pays more for hogs of a certain kind than another because he has a more profitable outlet for the pork products.

About 70 per cent of the meat in this country is consumed by people living east of the Mississippi River. Only about 37 per cent of the meat animals are raised in that area. Consequently

the movement of livestock is commonly eastward for slaughter and consumption. There is also some westward movement. Some hogs move from the corn belt states westward to the Pacific states.

Slaughter centers have moved towards the producing areas rather than consumption areas since it is usually more economical to ship meat than live animals. However, such is not always the case. Live hogs for example are often shipped from the Missouri River markets to California.

Leading states in hog production. There follows a listing of the states leading in the farm production of hogs. They are ranked in the order of their production.

Leading States in Hog Production

- | | |
|--------------|-----------------|
| 1. Iowa | 6. Ohio |
| 2. Illinois | 7. Nebraska |
| 3. Indiana | 8. Wisconsin |
| 4. Minnesota | 9. South Dakota |
| 5. Missouri | 10. Texas |

While the ranking is for a recent period, changes in conditions which effect hog production cause the order to vary.

Leading states in dressed pork production. As all hogs are not slaughtered in the state where they are raised, the leading states in hog production or raising and pork production or processing do not coincide. Below are listed the leading states in dressed meat production from hogs. This includes farm slaughter as well as commercial slaughter.

Leading States in Dressed Pork Production

- | | |
|--------------|------------------|
| 1. Iowa | 6. Kansas |
| 2. Illinois | 7. Indiana |
| 3. Minnesota | 8. Nebraska |
| 4. Missouri | 9. Wisconsin |
| 5. Ohio | 10. Pennsylvania |

In comparison of the hog and dressed pork output from states it will be noted that Kansas and Pennsylvania rank high in dressed pork but not in hog numbers. South Dakota and Texas



Here is shown a market hog-type demonstration which illustrates desirable market hogs to producers.

on the other hand are on the producing states list but not on the processing states list.

Methods of marketing. Many methods of disposing of hogs for slaughter and feeding are found. The following are the rather common outlets for market hogs.

1. They may be shipped to a large public stockyard and sold to a packer or shipper or a trader.

2. They may be sold to a local packer, feeder, shipper, or trader.

3. They may be sold at a concentration point.

4. Local buyers operating either individually, or for some general buying agency or packing plant may buy the hogs.

5. The hogs may be home slaughtered and the pork products sold.

6. Local auction sales are held in some sections for the sale of market hogs.

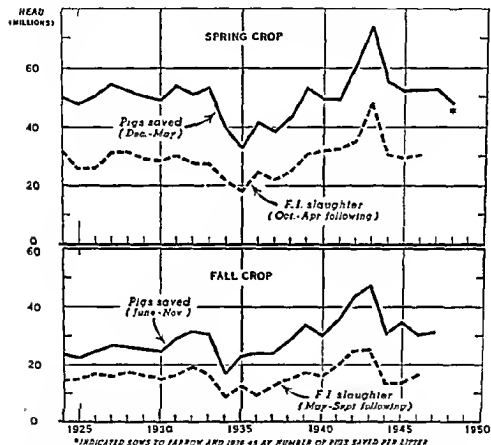
7. Local co-operatives may pool and sell for the members to any of the buying agencies.

8. Centralized co-operatives may handle the sales for the client.

The hog markets. The largest hog markets are located in the central part of the corn belt mainly because of dense hog popu-

lation. Packing houses are naturally located in regions nearest the hog centers. In the listed hog receipts Chicago is the leading hog market by a large margin. East St. Louis ranks second and

SPRING AND FALL PIG CROPS AND FEDERALLY INSPECTED SLAUGHTER DURING THE MARKETING SEASON FOR EACH CROP, UNITED STATES, 1924-48



U. S. Department of Agriculture, Bureau of Agricultural Economics

The size of the pig crop usually determines hog slaughter several months later.

Omaha third. South St. Paul, Kansas City, Sioux City, St. Joseph, Indianapolis, Denver, and Pittsburgh are also very large hog markets. See the current U. S. Department of Agriculture book on agricultural statistics or the *Driver's Journal Yearbook* for reports of receipts in different hog markets and data on hogs

slaughtered. The size of the pig crops usually determines the amount of hog slaughter several months later.

Kinds of packing plants. Two kinds of packing plants are recognized, the national plants, and the local or regional packing plants. The big four of the national packers are Swift, Armour, Cudahy, and Wilson. These four large packers slaughter more than half of the hogs slaughtered under federal inspection. In late years the large local packing plants slaughtered as many hogs as the large plants at the central markets. The advantages which have favored the development of the local plants are nearness to the supply and the small radius, usually less than 100 miles, in which they do business.

Movement in the packing industry. In the decentralization of the packing industry large packers located at the central markets have established buying points and plants in the producing areas. The corn belt has shifted; hence, the growing of hogs has also shifted, and, as a consequence, packers have moved toward the producing centers. It is evident that movements of hog numbers and of human population, and changing of the transportation system (trucking) have brought about a diffusion of the industry of pork packing. National packers usually have a high overhead, draw their supplies from distances, and many have a slow turnover, because of storage possibilities. However, the national packer has in most cases a wide outlet for his products and by-products and may operate to a high degree of efficiency.

Trucking a factor in method of marketing. Trucking of hogs to market has increased in popularity with the farmer. Nearly all hogs are moved from the farms where they are raised by motor truck. About two-thirds of the hogs arriving at public market are driven in receipt—that is, they arrive by truck. Trucking hogs has several points of advantage. Its chief asset to the shipper is the matter of convenience. The use of trucks in transporting hogs from the farm to the market has been one of the chief causes of the growth of concentration points and reload stations.

Co-operative shipping associations. There are many livestock shipping associations in the United States and several other associations that handle livestock as a side line. The increased use

of the truck in livestock marketing has driven many of the associations near the large central markets out of business. Successful associations have a large volume of business and function effectively as a sales agency.

Co-operative shipping associations have organized and central selling agencies have developed until there are many market co-operative commission associations. Ketner, of Ohio, gives the following advantages for co-operative marketing of livestock:

1. *Eliminates unfair practices.* Filling stock before weighing and favoritism frequently shown by buyers are eliminated.

2. *Losses reduced.* Shrink and consequently loss from filling reduced. Prestige enables collection of claims now frequently lost to producer.

3. *Efficient method of handling.* Duplicating, cumbersome, nonsystematic efforts replaced by straight-cut, nonduplicating, efficient system. Consequently, co-operative marketing is cheaper than other prevailing methods.

4. *Reflects grade of livestock.* Present marketing plan penalizes producer of quality stock and gives a premium to producer of scrubs. Co-operative marketing justly rewards producer of tops.

5. *Farmer retains control of product.* Solution of livestock problem necessitates control of stock by farmer in order to direct the movement and proper distribution of stock upon the market.

Direct packer buying. This practice is the sale of livestock to the packer without the intervention of a selling agency at the central market. Centralized marketing continued to develop in this country until the time of World War I, largely because of the long distances between livestock supplies and packing centers and the great distances between producing and consuming centers. Since that war there has been an increase in local interior packers, an increase in eastern slaughtering, and direct packer buying. There are points in favor of both systems, and in spite of opposition to "direct buying" the practice has increased. Its success is, of course, based upon satisfied patrons. The pro-

ducer must decide which market to use, for each has its advantages and disadvantages.

The advantages of centralized markets are:

1. There is a large number of competitive buyers representing large and small packers, shippers, and traders.
2. The services of skilled salesmen through commission houses are available.
3. A more definite record of receipts and prices is permissible.
4. A more careful sorting of classes and grades of livestock is possible at low cost.
5. Usually feeders get great fills at the market. This may or may not be advantageous.

The disadvantages are:

1. There is a risk of striking an unfavorable market as the hogs remain the property of the original owner while en route and until sold on the market.
2. The losses from shrinkage, deaths, disease, and live condemnations may be larger and are borne by the producers either individually or collectively.
3. There may be a lack of control of marketing costs.

The advantages of direct marketing are:

1. The terminal market charges of yardage, feed, and commission are eliminated.
2. The producer runs fewer risks.
3. Large shrinks are usually avoided.
4. More outlets for selling are available to the producer.
5. The seller is nearer the market and can take advantage of market changes.

The disadvantages are:

1. The producers are less experienced salesmen.
2. The livestock available at one point may be so small as to increase the buying expense of packers.
3. It does not provide a satisfactory basis for obtaining price quotations as there is decentralization of the buying.

4. As individual producers become salesmen in direct marketing, they need market news which they can interpret to determine where to sell and how much they should receive.

Opponents of direct-buying system contend that it causes a decreased demand at the large markets, consequently lower prices. However, place of purchase is a very questionable factor in influencing hog prices.

Increase in hogs shipped direct. There has been a marked increase in direct buying of hogs and a corresponding decrease in buying upon central markets. The other kinds of livestock have also increased in the direct transactions or sales to slaughterers at places other than public stockyards markets where the owner is represented by a commission agent.

For the ten-year period 1930-1939, about 53 per cent of the hogs slaughtered under federal inspection were purchased on the public stockyards markets and the balance were secured from other sources. For the past three years but 36.5 per cent of hogs slaughtered were purchased at public stockyards.

Market classes and grades of hogs. Hogs sent to a market are classified according to sex and use, and they are graded according to value. Thus we may market hogs classed as slaughter or stocker and feeders. Then there are the sex classes, barrows and gilts, sows, stags, boars, and pigs. The grades on division of classes are choice, good, medium, and common. Sorting may be done before shipping by the local buyer or shipping association, or it may be done at a reloading station or concentration point or at the central market. The establishment of reload stations by the packer saves sorting at the packing plant, makes possible the shipping of different kinds to the different plants, and saves on freight weight through the use of double-deck cars.

There are several factors which determine the use to which hogs are put and their value. Chief among these factors are weight, form, quality, condition, age, and sex. We have, then, a market class such as barrows and gilts, which indicates hogs of certain specification and as a consequence suitable for a definite use. Market classes may be divided into subclasses. They are further divided into grades, which indicate a division of about



Agricultural Marketing Service, U. S. Department of Agriculture

These are the official United States standard grades for certain swine, borrows, and gilts: U. S. No. 1, U. S. No. 2, U. S. No. 3, and Medium in order from top to bottom of the page. Cull grade is not shown.

the same value per hundredweight. Market grades are determined largely by conformation or form, finish, and quality. Mixed carloads of hogs may be sold to a yard trader who sorts and resells the hogs.

The purposes of the market classes and grades. The grading system allows producers to buy and sell by class and grade, greatly facilitates the mechanism of a large market, and is also of inestimable value in reporting the market. Newspapers and other publications, and radio reports tell of the activities of the market report by class and grade. A person on a farm can tell by current report the approximate value of his hogs. On large markets order-buyers operate. They buy for the eastern or western pack-

TABLE 59. SLAUGHTER HOGS

CLASS	WEIGHT SELECTIONS	GRADE
Barrows and gilts.....	120-140 pounds 140-160 pounds 160-180 pounds 180-200 pounds 200-220 pounds 220-240 pounds 240-270 pounds 270-300 pounds 300-330 pounds 330-360 pounds 360-400 pounds 400 pounds up	U. S. No. 1 U. S. No. 2 U. S. No. 3
Sows.....	270-300 pounds 300-330 pounds 330-360 pounds 360-400 pounds 400-450 pounds 450-500 pounds 500-600 pounds 600 pounds up	U. S. No. 1 U. S. No. 2 U. S. No. 3 Medium Cull
Stags.....	All weights	Ungraded
Boars.....	All weights	Ungraded
Unclassified.....	All weights	Ungraded

ers, and market classes and grades are indispensable for their successful operation.

Federal market classes and grades. The market news service reports of the U. S. Department of Agriculture are based upon the standard in which there is a schedule for slaughter hogs, slaughter pigs, and feeder swine.

Most of the hogs marketed are classed as barrows and gilts, formerly butcher hogs. The first grades were Choice No. 1, Choice No. 2, and Choice No. 3. These grades have been changed to U. S. No. 1, U. S. No. 2, and U. S. No. 3, and the carcass fat-back thickness requirement lowered. The U. S. No. 1 grade has the minimum finish for high-quality pork cuts. U. S. No. 2 grade has slightly more fatness, and U. S. No. 3 carries the most fat. Medium and cull are slightly and decidedly underfinished respectively. See Table 59.

Slaughter pigs. As in the case of slaughter hogs, different market classes, weight-selection groups, and grades of slaughter pigs have originated that are generally recognized and are more or less firmly established in the swine-marketing trade. These have been incorporated in the market classes and grades of slaughter pigs that follow.

Principally because of age only two market classes of slaughter pigs are recognized—barrows and gilts, and boars. Boar pigs, weighing approximately 60 pounds and over, are discriminated against sharply; consequently relatively few are sold for slaughter. Almost without exception, slaughter pigs that weigh ap-

TABLE 60. SLAUGHTER PIG SCHEDULE

CLASS	WEIGHT SELECTIONS	GRADE
All classes	Under 30 pounds 30-60 pounds . .	Ungraded
Barrows and gilts.	60-80 pounds 80-100 pounds	Good Medium Cull
	100-120 pounds . .	Choice Good Medium Cull

proximately 60 pounds and less are bought and sold without sorting as to class because the animals are so young that sex condition does not materially influence their conformation, finish, and quality.

Feeder and stocker pigs. Feeder swine includes both hogs and pigs. Usually the weight of 120 to 130 pounds is taken as the division between the two groups, hogs and pigs.

This group is relatively small. Feeder and stocker swine at the public stockyards are subject to federal inspection by employees of the Department of Agriculture. Those diseased and rejected as feeders and stockers are sold for immediate slaughter. Feeder and stocker swine are vaccinated against hog cholera and then dipped as a precautionary measure to prevent the carrying of disease germs or parasites that may have come in contact with the hair or feet of the animals while in the yard.

The trade in these pigs and hogs is heavy when the feeding ratio is favorable and when there is a shortage of feed in a producing area. This group includes hogs and pigs that show ability to take on, economically, additional weight and finish. They lack sufficient thickness and firmness of finish or fat to qualify for the better grades of slaughter hogs. The schedule for hogs and pigs sold as feeder pigs is given in Table 61.

Classes of feeder and stocker swine. There are five possible market classes of feeder and stocker hogs: barrows, gilts, sows, stags, and boars; and three possible market classes of feeder and stocker pigs: barrows, gilts, and boars.

In actual trading, barrows and gilts are the only market classes of feeder and stocker hogs and pigs that are bought and sold in sufficient numbers to establish a market. A limited number of sows are frequently sold as feeders during the spring and early summer months, but the number is seldom sufficient to warrant their segregation. When feeder and stocker hogs and pigs are actually bought and sold, barrows and gilts are considered as a single market class.

Choice grade feeder and stocker barrows and gilts have excellent conformation and quality. In detailed description choice feeder pigs comply with specifications for top hogs but lack in size and finish.

TABLE 61. FEEDER AND STOCKER SWINE SCHEDULE

CLASS	WEIGHT SELECTIONS	GRADE
Barrows and gilts.	120-140 pounds.	Choice Good Medium Common
	Hogs 140-160 pounds.	
	160-180 pounds.	
	80 pounds down.	
	Pigs 80-100 pounds.	
	100-120 pounds.	

Miscellaneous hogs. On the hog market there are some special groups not included in the regular classification. These are of very small numbers, and the usual market quotation does not include the miscellaneous group. Following are some which are included in this class:

Roasting pigs. Roasting pigs weigh from 15 to 50 pounds and are dressed shipper style—that is, with the head on. They are sold as whole carcasses. A thick, short, blocky pig that is well proportioned is required to qualify as a roasting pig. They are in demand during the holiday season and they go chiefly to hotels, clubs, restaurants, and steamships, and frequently through meat dealers to consumers.

Governments. Pigs and hogs which fail to pass the regular antemortem inspection are retained, tagged, and killed under special government supervision. This will include swine that are crippled, badly bruised, or show abscesses, and sows very heavy with pig.

Dead hogs. Hogs arriving at the market dead are disposed of by the tanking process, in which they are converted to grease and feeding or fertilizer tankage or meat scraps.

Roughs. Included in the group called roughs are the "throw outs" or hogs sorted out of other loads. These are coarse, rough hogs of all weights which are very inferior.

Soft or oily hogs. Carcasses that are soft or oily either because of softening feeds or immaturity are less desirable than firm carcasses. It is impossible to determine the softness or hardness on foot. Where soft hogs are numerous packers buy hogs subject to meeting hardness requirement, and settlement is based on the carcass and its hardness. Hogs yielding soft pork are docked

two cents or more per pound. Market quotations except soft or oily hogs from the general price range for a given weight and grade.

Selling hogs on grade and yield of carcass. Some packing plants will buy hogs and settle for them on the grade and yield basis, if desired by the seller. With this plan the producer of high-yielding and high-grading hogs may secure a premium for his hogs. In Canada this plan is widely used where the weighing and grading is done by government employees.

Dockage in the market. On some of the larger markets certain hogs are docked in weight when they are sold. Heavy stags are docked 70 pounds, heavy piggy sows are docked 40 pounds, light stags 35 pounds, and light piggy sows 20 pounds. In selling stags and piggy sows therefore the hog raiser should make certain as to the dockage practices employed on the available markets.

Chicago hog prices. As a large number of the market hogs are sold on the Chicago market, hog prices prevailing on the market are often given to illustrate price changes.

Monthly average hogs at Chicago. The price of hogs at Chicago may vary greatly from month to month. Table 62 shows the cycle of prices by months. Students should refer to *Drover's Yearbook* and *U. S. Department of Agriculture Yearbook* for prices in recent years.

From a study of the average price per 100 pounds of hogs at the Chicago market for different months, over a series of years, it will be observed: (1) that the trend of the yearly price has been upward since 1932 until 1948; (2) that cycles of high prices and low prices occur; (3) that there is a seasonal variation in hog prices.

Daily prices of hogs also present considerable fluctuation. The price at which livestock sells is determined largely by two factors: the volume offered for sale (supply); and the desire of the buying public to secure these products in the quantities in which they are offered (demand). As these factors are variable we have fluctuating prices.

Hog cycles. It has been demonstrated that well-established cycles occur with regularity in the swine industry. We have a period of prosperity and this is followed by a period of depres-

sion. These ups and downs are caused by over- and underproduction.

Seasonal variations in hog prices. As the receipts increase, the price decreases. Months of heavy marketing are months of low price. Most of the spring pigs are sold in December and January, and at that time low prices usually prevail. In U. S. Department of Agriculture Technical Bulletin, 894, the seasonal variation in hog price is expressed in per cent variation from average. The figures given in this bulletin are from the Chicago market for barrows and gilts 200 to 300 pounds for the period 1930 to 1941. Price controls and the release thereafter have altered the usual pattern.

TABLE 62. INDEX NUMBERS OF SEASONAL VARIATION IN PRICES FOR 200 TO 220 POUND GOOD AND CHOICE BARROWS AND GILTS AT CHICAGO 1930-41.¹
(U.S.D.A. Technical Bulletin 894)

MONTH	INDEX NUMBER	MONTH	INDEX NUMBER
January	93.2	July	109.0
February	97.4	August	112.2
March	100.0	September	112.9
April	97.1	October	100.7
May	96.8	November	92.0
June	100.3	December	88.4

¹Based on 1930-41 average of ratios to 12-month moving average, adjusted to add to 1,200

It will be noted August and September are months of high prices when receipts are low. Prices drop rapidly in the fall reaching the low point in December, when receipts are heavy. Picking the proper time for marketing may be a big factor in hog profit. For example if the yearly average hog price was \$10.00 per 100 pounds there would be a decline of \$2.45 from the September to the December price.

Breeding sows to be marketed. The practice of breeding sows that have had a litter while in the feeding lot is a rather common practice. A study of the results of this practice has been made at the South Dakota Agricultural Experiment Station and reported in their Bulletin, 386. It was found that producers have

nothing to gain financially from breeding sows during the fattening period when sows are full-fed on a good balanced ration and marketed at a high, good finish. The bred sows did make faster and cheaper gains but the loss in selling price slightly more than offset the advantage in efficiency of gain. This was true when no breeding charge was made for the bred sows and no discrimination existed in carcass price for the lower grade of bellies and softer carcasses in the bred sow group. Thus, it would seem advisable for producers to keep sows open during the fattening period. Furthermore, the practice of breeding sows that are being fattened for market lessens the opportunity of holding the stock to avoid any temporary market slump that is unpredictable at the time the sows are placed on feed.

The packer received practically the same returns for both groups after docking when assuming that the tankage from the uterus and contents paid for the labor and cost of processing them. If the packer had been forced to sell the carcasses on a discriminating market, his net returns would have been slightly less for the bred group.

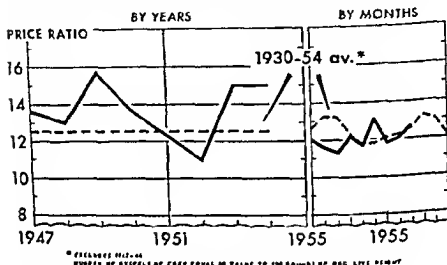
The small financial and efficiency difference between bred and open sows when fattened rapidly and slaughtered indicates that a producer can market bred sows up to 60 days after breeding without any great loss to himself or the industry, if conditions change to make this necessary. Thus producers have some chance to change production plans during the early part of the gestation period. Certainly, however, there is no advantage in breeding sows which are being fed to a good plus finish in a 60-day period and marketed.

Price by classes. There is less spread in prices between the various classes of hogs than is present in other kinds of livestock. This is due to the packer methods of preparing pork cuts from poorer hogs and to less variation, from a meat-animal standpoint, in the actual value of the classes.

Light-hog and heavy-hog prices. Within the market class of barrows and gilts or butcher hogs, light hogs, that is those about 200 pounds, usually bring higher prices than heavy hogs. During the fall when high hogs make up most of the market receipts heavy hogs may sell higher than light hogs. Also when feed sup-

plies are short of feeding ratios narrow heavy hogs may be scarce and higher priced than light hogs. If feed is scarce it may be advisable to sell hogs at lighter weights. Generally though throughout the year lighter weight pigs 190-230 pounds top the markets. See also best weight to market pigs, Chapter 9.

Sow prices. The low period of sow prices in comparison with



U. S. Department of Agriculture, Bureau of Agricultural Economics

This chart shows the hog-corn price ratio for a recent period.

barrows and gilts is during the months of July, August, and September. Sows of good grade, 400 to 500 in weight, are usually about \$1.00 less per hundred pounds than barrows most of the year. However, during the low-price period the price is about \$1.50 less per hundred pounds. This is based on the Chicago market prices during a recent period. Consequently the farm operator should finish and market sows as rapidly as possible after spring farrowing and suckling.

Hog-corn price ratio. The cost of the feed makes up the largest part of the total cost of producing hogs. Considering the United States as a whole, corn is the most important hog feed. Often a farmer is confronted with the question of the method of disposal of corn: Will it bring more sold outright on the market or sold through hogs? If corn is high in price as compared to

hogs, farmers use more feeds other than corn and sell the hogs when light in weight. A farmer cannot change his plans entirely because of unfavorable price ratio, but he can alter his operation to make the best of the situation. A rather general conception of the corn-hog ratio is that it is the amount of live hogs that can be produced by one bushel of corn. This is incorrect. The corn-hog price ratio is the number of bushels of corn 100 pounds of live hogs will buy at a given time. The ratio can be used to express market conditions for the whole country; but it is usually the ratio that exists on farms at the Chicago market.

Table 63 shows the number of bushels of corn required to buy 100 pounds of live hogs, based on averages of farm prices of corn and of hogs, and corn prices by regions, as estimated by the Bureau of Agricultural Economics, U. S. Department of Agriculture:

TABLE 63. HOGS AND CORN, 1943-1952

YEAR	HOG-CORN PRICE RATIO ¹		PRICE OF CORN PER BUSHEL ²		YEAR	HOG-CORN PRICE RATIO ¹		PRICE OF CORN PER BUSHEL ²	
	United States	North Central States	United States	North Central States		United States	North Central States	United States	North Central States
			Cents	Cents				Cents	Cents
1932-51 average.....	12.7	13.6	96.4	92.2	1948	13.0	13.2	188	186
1943.....	13.6	14.6	105	96.1	1949	15.7	16.1	117	113
1944.....	11.6	12.7	113	105	1950	13.7	14.0	133	130
1945.....	12.8	13.8	110	102	1951	12.4	12.6	162	160
1946.....	12.6	13.3	141	134	1952	11.0	11.3	164	159
1947.....	13.6	13.9	187	185					

¹ Number of bushels of corn required to buy 100 pounds of live hogs at local markets, based on average prices received by farmers for hogs and corn. Annual average is straight average of monthly ratios.

² Straight average of monthly prices.

Bureau of Agricultural Economics.

The average hog-corn price ratio for the United States has been for a long period 12.7 to 1; that is, 100 pounds of live weight of hogs have been sold for as much as 12.7 bushels of corn. When the ratio falls, hog production decreases, as farmers prefer to sell corn instead of feeding it. A favorable ratio causes an expansion in hog production which is followed by an increase in hog marketings. With the prices at the Chicago market the average price ratio is about 11.5. That is 100 pounds of the hogs

purchased by packers and shippers is equal in price to 11.5 bushels of No. 3 yellow corn. Apparently the supply of corn on hand is a better index of increasing farrowing. A 10 per cent increase in the supply on October 1 is accompanied by a 5 per cent increase in the sow farrowing the next spring.

Hog profits and losses. The relation between corn and hog prices causes the expansions and contractions which occur in swine production. Hog production is expanded when the feeding ratio is favorable and contracts when the reverse condition exists. There is a definite relationship between hog slaughter and price cycles, when an unfavorable ratio occurs breeding is decreased which is reflected in the number of hogs marketed some months later. When the farm price of hogs is approximately that of the farm value of 11.5 bushels of corn, hog slaughter tends to remain quite stable. Profits in hog raising increase as the farm price of hogs becomes higher in comparison with the farm value of corn and with the result that more hogs are raised. The process is reversed when hog prices go down. With low prices of hogs in comparison to corn, farmers sell the corn rather than use it as feed.

Preparation for shipping. Losses en route to market are reduced by proper preparation for shipping. Less loss is incurred in hog marketing than years ago because of better methods of handling and a greater knowledge of the causes of losses. The Western Weighing and Inspection bureau reported a ratio of 1 dead to 486 received in 1919; 1 to 936 in 1926; 1 to 937 in 1928; and 1 to 679 in 1929.

Suggestions for shipping hogs. The causes and prevention of shipping losses with hogs suggest the following precautions for successful hog shipping:

In a standard 36-foot car, load as near as possible to the minimum of 17,000 pounds single-deck and 24,000 pounds double-deck. Cars should be well cleaned, and in summer sand should be sprinkled over the floor to a depth of one or two inches and dampened before loading. A small amount of corn on the ear may be used. In loading be very careful in hot weather to avoid overheating. It is better to coax hogs into the car with corn than

to drive them around with sticks. Ice the cars by hanging a few chunks of ice in sacks in the top of the car. In the winter time the only requirement is that the car be dry and fitted with clean bedding.

The National Livestock Loss Prevention Board has investigated the proportion of the hogs that arrive at the market dead or crippled, on five markets over a five year period. The losses are expressed in percentages as shown in Table 64.

TABLE 64. PER CENT OF HOGS DEAD OR CRIPPLED ON ARRIVAL

	DEAD	CRIPPLED
Rail shipments.....	.060	.229
Truck shipments.....	.093	.220

Poor loading conditions, improper handling and the fact that more hogs in poor condition are shipped by truck account for the larger percentage of dead and crippled hogs arriving by truck. Damage other than that listed above is found on slaughtering. A recent study indicates that bruises are responsible for damage to the extent of 19 cents per hundred pounds. Nearly one half of the bruises occurred on the farm before loading.

Practices recommended in shipping hogs. By following certain shipping practices, it is possible to reduce death and crippled losses in shipping hogs to market. Based on a study of shipping hogs to market Wiley¹ has made the recommendations:

1. Not feeding hogs in cars during warm and hot weather, or when the maximum temperature during transit is 60 degrees or higher.
2. Cleaning cars, before loading, particularly during warm and hot weather, or from April to October, inclusive, for the corn-belt shipping territory.
3. Bedding cars with sand during cool, warm, and hot

¹James R. Wiley. "Death and Crippled Losses in Shipping Hogs to Market," Bulletin 318, Purdue University Agricultural Experiment Station, 1927.

weather (40 degree maximum temperature and above), and with straw or sand and straw during cold weather.

4. Showering hogs during warm and hot weather when the cars are bedded with sand.

5. Loading a 36-foot, single-deck car less than 18,000 pounds during cold and cool weather and less than 17,000 pounds during warm and hot weather. Under 20,000 pounds for a 40-foot single-deck car during cold and cool weather and under 19,000 pounds during warm and hot weather.

6. Partitioning large hogs like sows and stags away from smaller hogs, especially when they are not accustomed to running together.

Selling purebred hogs. There are two general methods of the sale of purebred hogs, the public auction and the private sale. There are also many variations of the two general methods. The auction sale is a more recent development in the selling of breeding hogs and by its use a number may be sold in a short period of time. The auction sale is used by swine breeders who are conveniently located; that is, so their place of sale is accessible, and who have fairly large numbers to sell. The greatest objection to such a form of sale is the matter of expense. The small breeder sells his surplus by private sale or auction put on by groups of breeders.

The standard purebred swine guarantees covering the sale of breeding stock at private treaty or in public auction as given in Chapter 4.

SUGGESTIONS FOR FURTHER STUDY

1. Determine the cost of shipping hogs from your point or various markets by freight and truck.
2. Visit the local stockyards on a day when hogs are being shipped out. Determine the final destination of the hogs being shipped out, also the slaughters to which they are consigned.
3. Make a study of the reports, rules, and regulations of local co-operatives that are handling hogs.
4. Attend the meeting of the co-operative shipping association.
5. Assist in the loading of a car of hogs for shipping to the market.
6. Attend an auction sale of purebred hogs.

7. Make a graph showing the monthly fluctuation of hog prices at the market which receives most of the hogs from your county.
8. Make a chart for keeping the daily record of the Chicago hog prices or some market in your area.
9. Visit a packing plant and note the extent of bruised carcasses from the animals slaughtered.

REFERENCES

- DOWELL, AUSTIN A. and KNUTE BJORKA. *Livestock Marketing*. McGraw-Hill Book Co., New York
- NORTON, L. J. and L. L. SCRANTON. *The Marketing of Farm Products*. The Interstate Printers and Publishers; Danville, Illinois
- SHEPHERD, GEOFFREY. *Marketing Farm Products*. Iowa State College Press, Ames, Iowa
- North Central Regional Publications:
- “Marketing Livestock in the Corn Belt Region,” by Corn Belt Livestock Marketing Research Committee, South Dakota Agricultural Experiment Station Bulletin, 365
- “Trucking Livestock in the Corn Belt Region,” by Corn Belt Livestock Marketing Research Committee, Missouri Agricultural Experiment Station Bulletin, 479
- United States Department of Agriculture:
- Market Classes and Grades of Swine*, Circular, 569
- Feed Consumption and Marketing Weights of Hogs*, Technical Bulletin, 891
- Pig Crop Survey Reports
- Bureau of Agricultural Economics Situation Reports
- The Agricultural Situation*, issued monthly
- The Agricultural Outlook Digest*, issued monthly
- The Farm Income Situation*, issued monthly
- The Feed Situation*, issued monthly

CHAPTER 20

Operating the Swine Enterprise

A SURVEY of the cost of producing hogs in your community will indicate a wide variation from farm to farm. The efficiency of the swine project is usually a large factor in the income from a corn-belt farm. On some farms hogs actually lose money. The production costs will be twice as high on some farms as on others. The difference between the cost of production and the income from hogs is the profit. The operator through his management of the swine enterprise can affect the profits. Swine production should be organized and operated to yield a profit to the operator. It has been found that generally farmers who specialize on a few major lines have the highest average net income year after year. Therefore it may be inadvisable to add hog production to a farming program just to have another enterprise.

In keeping down costs of hog raising the manager must give attention to using efficient breeding stock, raising large litters, selling hogs of the kind and weight desired and using productive pasture crops and grain crops and controlling diseases and parasites.

Further, there must be an efficient use of labor, buildings, and equipment. Some operators are adept in operating the farm and the swine project while others lack the ability to handle swine production effectively. Lack of experience, lack of proper facilities together with disease and parasite losses are frequent causes of failure.

In the discussion that follows on swine farm operation the general divisions are, managing the enterprise, record keeping.

and production costs. Other phases of operating are covered in other chapters.

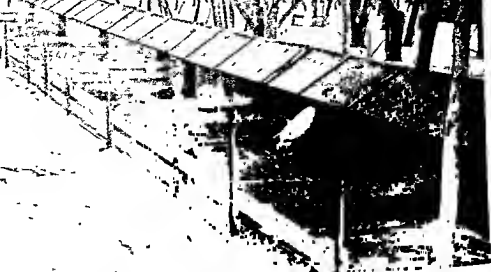
MANAGING THE SWINE ENTERPRISE

Specialization. Very few farms keep hogs to the extent that the other common farm enterprises are developed. Hog raising is but a part of the farm program and in many cases yields a large amount of the farm income. Yet about the only hog farmers who specialize highly are the breeders of purebred hogs. The production of hogs, then, must be looked upon as a means of diversification, that is, an opportunity away from a one-crop plan. Hogs are kept on farms to utilize farm wastes and to provide a market for farm-raised grains and forage. The swine enterprise, because of its flexibility, lends itself to the adjusting of production to take advantage of changes in the relative prices of farm products. This is particularly true with corn and hogs. Hog production is flexible as compared with other livestock production because of the rapidity with which it may be expanded and the range of market weights that may be profitable to the feeder.

The farm operator can shift the farrowing time to meet his situation. He can vary the number bred and sell the sows on the market after they are bred. Also there is the possibility of altering the general feeding pattern from limited to full feeding.

Fitting the swine enterprise to the general plan of farming. Whether the production of swine fits into the general farming scheme depends upon the following conditions:

1. The physical character of the land. Some farms, because of the lay of the land and other characters of the soil, are not suited for hog raising.
2. The productiveness of the land in raising concentrates and forage crops.
3. The amount of feeds that would have to be purchased.
4. The advantages which may be derived from the combining of hog production with other livestock production.
5. The amount of labor that may be available for the hog enterprise.



This is a handy layout for raising pigs until the pasture is ready for use. A good farm operator plans his swine enterprise.

6. Farms which can raise large numbers of hogs have an advantage over other farms because of labor and equipment utilization.

7. The crops which may be harvested by hogs.

8. The plan of hog production which may be used.

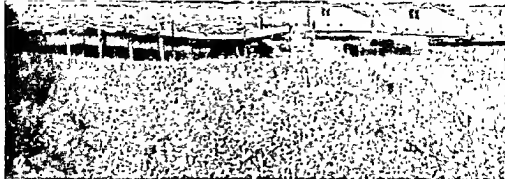
9. The linking of hog production with the soil-fertility maintenance plan.

10. The time of year when hogs can be marketed.

In addition to the above, swine raisers must consider the farm operator, or help available. Some men are expert at swine raising while others are decidedly lacking in that ability.

An efficient farm layout. A farm well suited to hog raising should be arranged so that the enterprise may be carried on efficiently and with the minimum of labor. The fields should be fenced hog-tight and a rotation planned. Eliminate useless fences and waste space in laying out the fields. Rectangular fields, involving short travel from the barn to the fields, are desired. Time and thought spent in laying out the farmstead and buildings saves in man labor and horse labor. Locate the hog barns, the feeding yard, the corncrib, and the scale so that they may be conveniently used.

Limiting factors in a farmer's ability to produce hogs. The swine business may be increased very rapidly but there are at



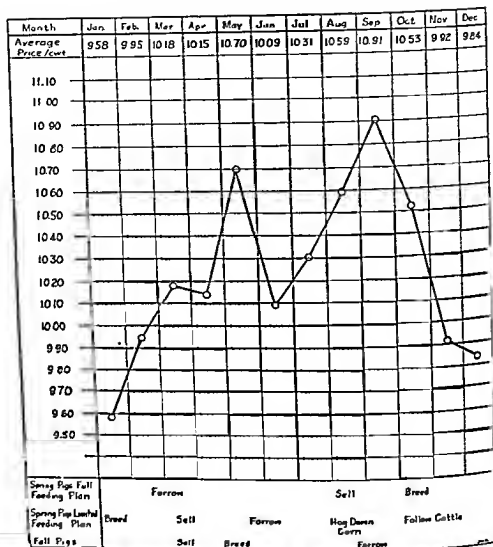
Here are some more pigs on pasture. Note the equipment, waterers, movable houses, feeders, and sunshade. A complete layout reduces labor in pasture raising of pigs.

least two factors which may prevent expansion of production on a given farm. In the first place, there may be a lack of breeding stock at the time of the breeding season, and, in the second, there may be a lack of capital and equipment for the handling of hogs. Both of these factors may be overcome under usual conditions, and expansion generally goes forward, at the rate desired by the farm operator. When conditions are favorable, more sows are kept in the breeding herd, yet there may be a time when there is a lack of breeding stock.

Adjusting hog production to market demand. If the farmer would have hog production become more profitable, he could find it to his advantage, in addition to producing efficiently, to meet market demands in the following ways:

1. Adjust production from year to year according to the outlook for hog prices, rather than by past prices, or by prices prevailing at time of breeding.
2. Take into account changes from year to year in price relationships between hogs and other enterprises, such as cattle, sheep, corn, etc., and select from the alternative lines of production one or more which give promise of yielding the greatest net return to the farm business as a whole.
3. Sell hogs, insofar as costs and prices justify, in those months when hog prices usually are highest.
4. Vary the weight to which hogs are fed and marketed according to the relationship between corn and hog prices.

It is possible to make changes in the scale of the hog production enterprise from year to year without disrupting the farm



This shows the average price of hogs by months; 10-year period; Chicago market.

organization to any great extent. The important thing is to make the adjustments at the proper time. When this can be accomplished more stable prices will prevail.

Timing production to marketing. It is quite evident that the question of marketing is to be thought of in laying out production plans. Hogs when finished can seldom be held a long period for a favorable turn of the market. From the time the sow is

hired until the pigs are ready for market may take from nine to twelve months, or even more, depending upon the kind of hogs and the method of feeding. Study page 456 and note the three suggested plans of production and the timing of the plans as compared with the market price. In these suggested plans the one selected would depend upon the equipment available on the farm. See also seasonal variation in hog prices Chapter 19, which gives the percentage variation by months.

Full-feeding of spring pigs has some advantages as it makes the maximum use of forage, and the winter-feeding period is eliminated. In this plan, sows bred in November farrow in March, the pigs are full-fed on forage and are ready for market in August or September. The cull sows may be marketed then in June, or rebred for fall litters soon after the spring litters are weaned. The disadvantages are the uncertainty of the weather and the extra equipment needed for early spring farrowing.

Limited feeding of spring pigs. The merits of the limited-feeding system are: favorable farrowing season; minimum equipment required; pigs of the greatest use for hogging-down corn, following cattle; and pasture utilization. The sows are bred in January, farrow in May, and the pigs are marketed during the late winter. This is the one litter a year system.

Full-feeding fall pigs. The greatest difficulty is the winter feeding period, to which might be coupled the need of extra equipment. The sows are bred in May, farrow in September, and the pigs, being full fed, are ready for market in February or later.

Factors to consider in timing production. In the outline of a production and marketing plan suitable to a given farm and situation, the farm operator should give consideration to the following points:

1. *Equipment available.* Without ample equipment some plans are not feasible.

2. *Production costs.* It may be that, because of production costs, more profit can be made by an efficient producer on a low market than a poor producer on a high market. The rate of gain must also be taken into consideration.

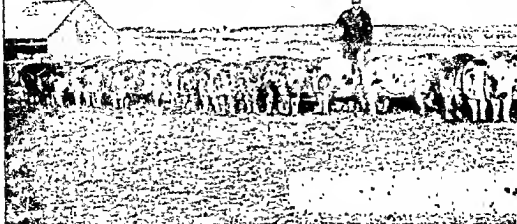


Here are some market hogs in the winter feed lot. Note the alfalfa hay feeder in use. Shelter, proper equipment, and good rotation with good breeding are needed in efficiently operating the swine enterprise in winter.

3. *Market requirements.* Usually breeders have the highest market for light hogs in September and October, and the highest market for heavy hogs in October and November as well as late spring, comparatively speaking. That is for market hogs classified as barrows and gilts. Sow prices are high relatively at the same periods. The current demands of the market are also to be considered.

4. *Adaptability of the plan.* The plan chosen should fit in well with the other farming plans.

Comparison of various farm enterprises. The incomes from most farms are quite varied. Diversification is stressed because of greater stability and distribution of labor and income. On the other hand, small minor enterprises are apt to be neglected and less profitable than larger ones. Accounts of the farm, to be of the greatest benefit, should show which of the enterprises are profitable and which are unprofitable. They should show the income and expense in connection with field crops and the different kinds of livestock because of a lack of profit for one year. Branches which continue to prove successful are to be expanded, while those not successful should be contracted. The well-posted



Here is a healthy lot of crossbred gilts being hand-fed in winter.

farmer knows in advance when to expand or contract in each line.

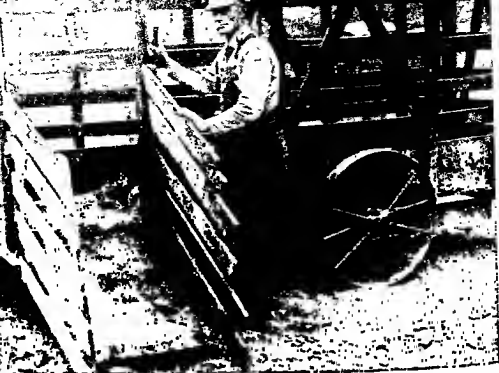
Different parts of the swine enterprise. On a purebred hog farm there are two sources of income, one from the sale of breeding hogs, the other from the sale of market hogs. Careful cost records show which line is the most profitable. Also, on a hog farm different methods of feeding are tried, for example limited feeding, full-feeding, hogging-down corn, following cattle, etc. Records of costs show the manager the relative profitability of each method under the existing conditions.

Making hog production easier. In the Bulletin 504 Purdue University, *Simplifying the Work and Management of Hog Production*, suggestions are given to help farmers lower hog-production costs. This is done in two ways, to help the hog producer do essential jobs well and decrease the time and hard work required. The suggestions given were divided into the following classes:

1. Have a definite system of hog management and housing.
2. Use an easy method of providing adequate water.
3. Store, prepare, and handle feed the easy way.
4. Provide proper building and equipment.
5. Watch for small savings in time and effort.
6. Keep efforts to save time in line with results accomplished.

RECORD KEEPING

Farming should be considered a business, and hog raising is just one part of that business. As one cannot remember all of the details of the farm, records are a necessity if business meth-



Here is a trailer and loading chute for handling hogs. Proper equipment makes it easier to handle the swine herd.

ods are to be employed. Good records provide a basis for determining ways to do more profitable farming.

What records to keep. The kinds of records that a farmer keeps are dependent on what he wishes to know about his business. An inventory is fundamental to any system of records. Every farmer should make an annual inventory since it tells a farmer how much he is worth. Also it is necessary for tax purposes. It may aid him in securing needed bank credit for loans. An inventory at the beginning, and another at the end of a year show how much money has been made or lost during the year.

A record of cash received and expended is the next logical step. The inventory with a cash account enables one to figure how much the farm pays him for his labor after other operating costs have been deducted. Such a record can be used in locating many of the leaks in the farm business and from it many suggestions for improvement can be drawn; it enables a farmer to comply fully with all income-tax requirements and in the long run will make his tax lighter.

Some farmers desire to know costs on each enterprise, but such an account makes necessary the recording of labor distribution in various enterprises each day and feed distribution at stated intervals. The complete cost record is very useful but requires more time than the average farmer should put on farm records.

Where farmers wish to keep more than an inventory and a financial statement of their farm business, but do not wish to keep complete cost records, a single enterprise record on the one, two, or three most important enterprises will prove helpful, but the single enterprise record without the use of the inventory and cash account is likely to be misleading.

Uniform system of farm accounts. Most state agricultural colleges, through their extension service, have outlined a uniform system of simple farm records. These generally contain the inventory and financial forms of the greatest use to the average farmer of the particular state. There is a big advantage in using a uniform system on all farms. It enables all to become familiar with terms of uniform meaning and uniform methods of analysis. Write to your state college extension service or contact your county extension director for information and forms.

Records (1) condemn poor sows, (2) help select best sows for rebreeding, (3) aid in selling pigs, (4) detect and eliminate wasteful methods and other unprofitable phases, (5) help in comparing prices of purchases and of sales, (6) help in preparing for emergencies, and (7) help in planning the future program.

Importance of keeping swine records. Purebred herds cannot be maintained without adequate records. For such herds it is necessary to keep a breeding record to determine the farrowing dates. In addition, it is advisable to keep a hog-sale record and to keep a general expense record to work up a yearly summary. A pedigree record is a necessity in the purebred business, and its value is worthless if inaccurate. It is advisable, at the same time, to keep a record of applications for registration and pedigrees sent to buyers.

A market hog raiser may or may not keep records but the following records will of material assistance in the management

of the sales, include the information about the hogs set forth in the yearly financial record.

The most helpful feeding record a farmer can keep is one which gives the amount and cost of feed needed for each period, for example:

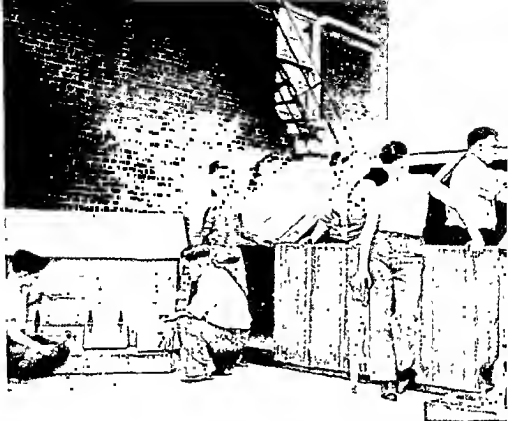
1. Wintering the sows
2. Suckling period
3. Pigs from weaning until marketed

Feed records based on these divisions will show the proportionate expenses and assist the farmer in making future plans for the hog enterprise.

Production records. Some measures of production have been set up for swine. However, it is more difficult to apply them under farm conditions than those advocated for the dairy cow. In the case of sows used for market-hog production, the records probably cover only the number of pigs farrowed. A record of the number of pigs raised to weaning, and their weight and condition at that time would involve some labor but would also give a definite standard upon which to base selection for production. This record is available two months after the pigs are farrowed. The operator may then decide if the sow should be retained for breeding, or sold on the market.

Making the inventory. A complete listing of all the property at a given time, together with a valuation of each item, is known as an inventory. This includes the animals, the land, all buildings, the different articles of equipment, such as hog houses and waterers. The feed on hand must be listed. Assets and liabilities are listed. The valuation is given for each item. A manager cannot compare the success of one year's business with another without a complete and accurate inventory for each year. The inventory should be made the same date each year, either January 1 or March 1. The latter date is often the moving date of tenant farmers and is usually the time when the storage of feed on the farm is low. The livestock on most farms, especially hogs, is also the lowest at this time, that is just before farrowing time.

Purpose of the inventory. An inventory requires thought and work. If it is only a tabulation of items, and is not used as a



These high school students are building equipment for hog raising.

Project record books. Records are usually required of vocational students on swine projects. Farm books are provided by schools and state or district supervisors. Projects with ten litters may require special forms which should be secured.

PRODUCTION COSTS

The cost of the feed is the largest item of production cost. This emphasizes the necessity for careful adjustment of the ration to suit the situation and selection of economical feeds. However considering the other portions, total cost is important in keeping down production costs. We may easily be too high in our production costs for labor, buildings, equipment, and other items.

Proportion in various cost items. Feed will usually make up about 80 per cent of the total cost of production. Labor is about 7 per cent while the remaining 13 per cent is for interest charges, depreciation of buildings and equipment, bedding, veterinary, overhead, and other expense.



This is a summer meeting discussing hog-producing problems.

Considering feed as 80 per cent of the total cost it is therefore necessary to secure net income of \$125 for each \$100 invested in feed for the swine enterprise.

Actual returns from the swine enterprise. An analysis of feed records from 123 lower income farms for one year in Iowa, indicated that the swine enterprise returned \$145.00 for each \$100.00 expended for feed including pasture. For the average 8.2 bushels of corn or equivalent 41 pounds of protein concentrate plus some pasture was required for 100 pounds gain. The estimated cost of the pasture was 23 cents per 100 pounds gain. This was based on the pasture used and the cost thereof. The 31 farms having the highest returns had an income of \$186.00 for each \$100.00 feed cost. The same number of low-return farms showed an income of \$110.00. It is evident that hogs lost money on those farms. On the better producing farms 6.4 pigs were raised per litter whereas 6.0 pigs were raised per litter on the less productive farms.

The above was for a fairly representative year. Over a period of 14 years the return was \$159.00 for each \$100.00 spent for feed.

Feed budgets. In order to plan properly for the swine enterprise the farm operators should make up a feed budget. This will enable the feeder to determine the adequacy of the feed supply and to calculate how much feed will have to be pur-



A demonstration of desirable hog types is given at a winter meeting of the hog raisers held at a stockyard.

chased. The approximate feed requirements given in the next section will assist the student in making a feed budget.

Feed requirement for swine. Investigations of the feed required to produce a market pig have been summarized by E. L. Quaife of the Iowa State College. The summary includes information from field surveys as well as data from experimental trials. The feed requirement is given in Table 65 on page 468.

It will be noted that a 225-pound pig will require 12 bushels of corn, $1\frac{3}{4}$ bushels of oats, 34 pounds of alfalfa, 50 pounds of pig starter and grower feeds, and 118 pounds of supplemental feeds, including minerals, for its production. This is a total of 938 pounds of feed and includes the pro rata share of the breeding feed.

SUGGESTIONS FOR FURTHER STUDY

1. Make a study of your home farm and determine, if possible, the profitableness of the various enterprises. Outline a suitable plan for the management of your farm.
2. Inquire from a number of farmers in your locality, the reasons for local farm failures.
3. Determine the methods of the farmers in your section who have been successful hog raisers.
4. Determine, if possible, the relative importance of the different farm enterprises in your locality.

TABLE 65. APPROXIMATE AMOUNTS OF FEED TO PRODUCE A 225-POUND PIG (DRY LOT)

	CORN (lbs.)	OATS (lbs.)	ALFALFA (lbs.)	SUPPLEMENT (lbs.)	PIG FEEDS (lbs.)	MINERALS (lbs.)
Brood sow gestation period (120 days)	240	240	240	90	...	1
Brood sow lactation period (42 days)	308	154	...	63	...	1
Suckling pig, pig starter until weaning (42 days per pig)		...	..	..	15	...
Weaned pig, pig grower (14 days—from 42 to 56 days old and to 40 pounds weight)		.	..	...	35	...
Litter (7 pigs, 40 to 225 pounds)—corn, supplement, and minerals (325 pounds corn and 50 pounds supplement and 2 pounds minerals for 100 pounds gain)	4,208	.	...	647	...	28
Total feed per litter (7 pigs)	4,756	394	240	800	...	30
Total feed per 225-pound pig	680	56	34	114	50	4
Total feed per bushel and pounds	12 bu.	1 $\frac{3}{4}$ bu.	34 lbs.	114 lbs.	50 lbs.	4 lbs.

5. Make a survey to determine what records farmers in your locality keep.
6. Prepare a set of record blanks suitable for keeping swine records.
7. Obtain a uniform farm account book from your agricultural college.
8. Obtain cost-account records kept on some farms in your section and make a study of the same.
9. Get blank income-tax forms to fill out for a definite farm.
10. Confer with several local farmers to find out their estimate of the value of farm records.
11. Select a typical hog producing farm in your area and determine the cost of raising hogs on that farm. Also make a study of the methods used on that farm.
12. Make plans for producing hogs on a farm and prepare a feed budget for the hog enterprise.

REFERENCES

- COFFEY, JOEL S. and LYMAN E. JACKSON. *Livestock Management, Revised*. J. B. Lippincott Co., Chicago
- ROBERTSON, LYNN S. and RALPH H. WOODS. *Farm Business Management*, J. B. Lippincott Co., Chicago
- United States Department of Agriculture:
Farm Bookkeeping. Farmers' Bulletin
Swine Production. Farmers' Bulletin

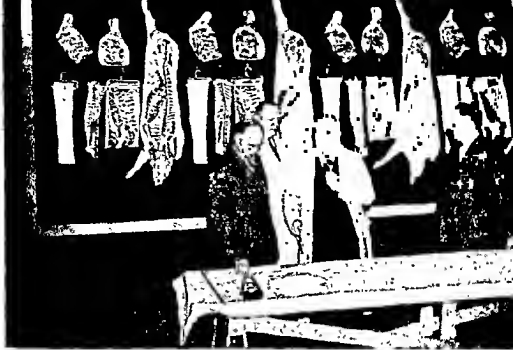
CHAPTER 21

Slaughtering Hogs

THE PURPOSE of this chapter is to cover the farm slaughter of hogs, also the cutting and curing of pork on the farm. In spite of factors which tend to lessen hog slaughter on farms to date there appears to be no material downward trend. However farm slaughter was greatest during the depression years. Now much of the so-called farm slaughter is done at locker plants.

The home meat supply. Pork and lard are popular food items on the farm. Many hogs are used on the farm on which they are grown as a home supply of meat. Of the slaughter animals the hog is used to the greatest extent for home slaughter. Over 40 million hogs are slaughtered annually in packing plants under federal inspection. It has been estimated that the number of hogs slaughtered, not federally inspected, amounts to between 25 and 30 million head annually. Farm slaughter is about 12 to 14 million head yearly. (See Table 73 in the Appendix.) The popularity of the hog for home slaughter is due to the following reasons:

1. Little equipment and labor are required to dress a hog and prepare and cure the meat.
2. There is relatively less waste in hogs slaughtered on the farm than in other farm-slaughtered animals.
3. The meat is varied. Part of it is used fresh and the remainder is used in the form of cured meat and lard.
4. Pork is relished by a great number of people. In fact, more pork is eaten than any other meat.



This is a demonstration on the differences in pork cuts from hogs of various types and degree of finish.

5. A hog carcass can be disposed of economically by an average family during the colder season.

6. Numerous meat products are made on the farm from pork.

Selection of hogs for butchering. *Health* is an all-important factor to be considered in selecting hogs for butchering. There is always danger of transmitting disease to the consumer of meat of an unhealthy animal and the slightest diseased condition will impair the keeping qualities. Be sure that the hog is healthy regardless of his condition, quality, or age. Tuberculosis and hog cholera are the two more common diseases of swine.

Injured animals should be killed, bled, and dressed as soon as possible after the injury occurs. Otherwise the blood will collect in the injured spot and inflammation may arise, which may cause the meat to sour, either before or during the curing process.

Condition. Animals should be in medium condition of flesh, not too fat. The muscles of a thin hog are quite often tough and lack the flavor and juiciness characteristic of a well-marbled piece of meat. On the other hand, overfat, oily hogs will not product high-class cured pork. One of the common faults of

country-cured pork is that it is too fat. Many farmers think that the fatter the hogs, the better the meat, but this is a mistake. Hogs in medium condition, weighing 200 to 250 pounds, produce the most satisfactory meat for curing on the farm.

Age. Hogs may be slaughtered at any age after six weeks. However, the meat from young pigs is watery and lacks the firmness, flavor, and keeping qualities of meat from hogs with a little more age. On the other hand, the meat from old hogs is generally less tender. Hogs from six to ten months of age usually give the best results. Lean meat from young animals is nearly white; from older animals it is rose-colored.

Breeding and type. The old-fashioned lard hogs do not produce the right kind of hams, shoulders, and bacon. They have too great a proportion of fat to lean for the average consumer. The recent intermediate type of lard hog is producing far better meat. For the very best hams, shoulders, and bacon, select some of the meat-type hogs that border on the bacon type.

Quality. Smooth, evenly fleshed hogs produce a finer quality of meat, and cut up with much less waste than the rough, coarse, wrinkled, flabby individuals. The quality hog always shows more marbling, dresses a higher percentage of edible meat, and gives a more tender, finer-textured product.

Sex. Boars should never be killed for pork. The meat has a strong, unpleasant odor and flavor. They should always be castrated and put on full feed until they are entirely healed. The pregnant sow is all right for pork if she is not too near the farrowing time.

Dressing percentage. One of the very important factors to be considered in the selection of hogs is dressing percentage. By dressing percentage is meant the proportion of chilled dressed carcass to live weight. If a barrow weighs 200 pounds live weight and the dressed carcass weighs 150 pounds, the dressed carcass would weigh 75 per cent of the weight of the live animal. Buyers always consider dressing percentage when buying meat animals of any kind.

Hogs will dress from 60 to 90 per cent of the live weight depending upon age, condition, heavy middle or fill, quality, and style of dressing. Hogs from 6 to 12 months of age in high con-

dition, usually dress higher than younger hogs in lower condition.

Management of hog before slaughtering. Hogs should not be fed for at least 24 hours before killing, for several reasons. They should, however, have plenty of clean water during this time. (1) This will give the hog a chance to get rid of most of the contents of its stomach and intestines, which is a big help in removing and cleaning the organs. (2) It is easier to get a good bleed when the system is not gorged. (3) It is quite a saving of feed. This may seem like a small item for one or two hogs, but with the hogs killed annually in the United States it will mean a great saving of feed. (4) The meat always cures better when the small blood vessels are practically free from food products and blood.

Hogs should never be excited or overheated before killing. This may raise the body temperature above normal or produce a feverish condition which has a tendency to cause the meat to sour.

Never bruise or whip a hog just before killing. This not only tends to excite the animal, but causes the blood to collect in the bruised spot. If this happens to be on the ham, shoulder, or bacon, it must be trimmed out before going into the cure; otherwise it will sour. If the bruise is on the fat back, it will have a tendency to darken and lower the quality of lard.

Tools and equipment needed. *Tools.* The tools which are commonly used are: (1) a common butcher knife with a blade about eight-inches long; (2) a steel which is used for putting an edge on the knives during the process of dressing and cutting; (3) a meat saw; (4) a stick or bell-shaped hog scraper; (5) a hog hook at least 15 inches long; (6) a hog gambrel stick.

Equipment. A means of heating water is required and the scalding can be conveniently done in a barrel. A platform with the scalding barrel leaning on it is very satisfactory for the scalding and scraping operations. In addition to these equipment needs, some means of handling the carcasses is needed.

Sticking and bleeding. On the farm, hogs are commonly stunned with an ax or sledge or shot with a rifle before sticking. This is not necessary, for two men can hold and stick a hog. The pig is held on his back with the attendant standing astride the

pig and holding the front legs. The person doing the sticking holds the pig's lower jaw with his left hand and handles the knife with the right hand. An eight-inch, straight butcher knife is very satisfactory. The hair is scraped from the throat down to the breast bone. An incision about four inches deep from the breast bone up the jaw is made along the midline. The knife is then inserted at an angle of about 35 degrees in the incision about two inches in front of the breast bone and forced towards the back bone and under the breast bone. The carotid arteries and jugular vein front of the chest cavity are severed. After the hog has been stuck and is bleeding well it may be released.

Scalding and scraping. As soon as the pig is dead it should be scalded. Water from 145 to 150 degrees is needed. If the water is heated in a kettle and is to be put in a cold barrel it should be nearly boiling as it cools rapidly. Care should be taken not to have it too hot. In the absence of a thermometer the usual method of testing is to dip a finger in the water three times. If the water is too hot to dip the finger in three times, it is too hot for scalding hogs. Water that is overly hot will "set" the hair and then must be removed by shaving.

Soaps or alkalies are often added to counteract the hardness of the water and act in removing the scurf from the hog.

The hog hook or rope is inserted through the lower jaw to handle the pig during the scalding process. When a barrel is used, the rear end is scalded first. With a scalding vat, the entire hog is immersed. While the hog is being scalded it should be kept moving. When the hairs start to slip it may be pulled out for airing. When the scalding is completed so that the hair may be removed with ease by the hands from the legs the pig is taken out and scraped.

A candlestick scraper is a very convenient tool in scraping off the hair and scurf. The feet and legs are to be scraped first, scraping with the hair. Finally the remaining hair is shaved off with a knife. Shaving is facilitated by liberal application of hot water.

To insert the gambrel stick, the tendons on the back of the hind legs are loosened. A long incision is made from the lower part of the hock to the dew claws. The first tendon is just

under the skin and the second is immediately below. It is loosened by cutting along either side of the groove in which it lies. A singletree may be used in place of the gambrel.

Skinning. Some prefer to skin the pigs rather than scald and scrap them for home slaughter. This practice eliminates the need for heating the scalding water, also one man can do the whole job alone. It takes an experienced operator to do a good job of skinning. In skinning the hide is opened along the back of the fore

and hind legs and down the middle line of the belly. The legs are skinned out. Then the belly and sides are skinned. The gambrel are put in the tendons of the hind legs and the tongue and tail loosened. The skin is pulled off the back and the balance skinned out as the carcass is being hoisted.

Suspending. Some arrangement should be provided about six feet high for hanging the carcass. Before hanging, the tongue is loosened by cutting inside on either side of the lower jaw. When it is properly loosened it may be readily removed with the pluck. After the carcass is hung it is washed with hot water and scraped again with a knife. This is followed by a washing with cold water and another scraping.

Removing the entrails. A cut is made between the hams to the pelvic bones. The pelvic bones or aitch bones are separated at the natural division which is indicated by a white seam of connective tissue. This makes a ridges which can be located in the pelvic opening. The rectum is loosened by cutting around it. A long cut is made along the median line to the throat. With barrows the penis and sheath is removed by cutting around it



Here is shown the abdominal cavity being opened during the dressing process.



Here the entrails are being removed from a hog.

and severing near the hams. The breast bone is cut upward from the cut made in sticking. The abdominal cavity is then opened by using both hands, the left being on the inside to prevent cutting the intestines.

The liver is taken out by putting the hand under it and pulling it upward. The gall bladder is then cut off carefully. The content of the abdomen is pushed downward and removed.

The pluck includes the organs of the chest cavity. The diaphragm, or division between chest and abdominal cavity, is cut free at the

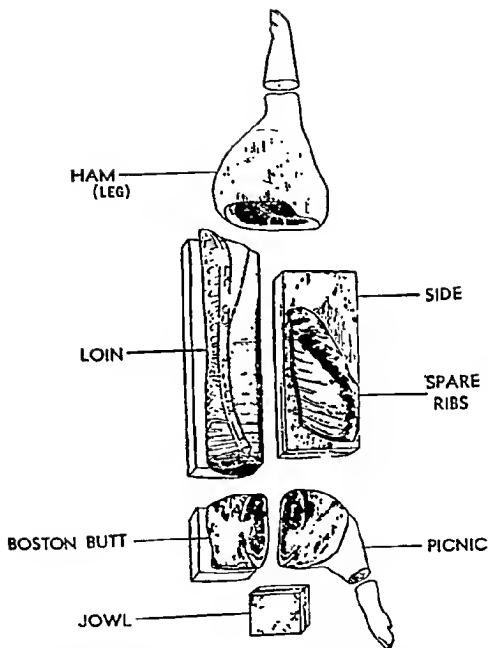
beginning of the muscle tissue. This is all pulled downward and removed through the opening in the front part of the chest. The tongue, if previously loosened, will come out with the pluck.

The leaf fat, which is on the inside of the abdominal cavity and surrounds the kidneys, is removed or loosened. If this is not done during dressing it is difficult to remove.

Splitting. The carcass is usually split down the backbone. This allows it to cool more rapidly and facilitates cutting. After splitting, the inside of the carcass is washed with clean water.

Cutting and curing pork. The illustration on page 477 shows the relative location of the various pork cuts, common with the wholesale trade. After the carcass has been cooled it may be divided into the pork cuts. Soft pork is difficult to cut smoothly. A knife, steel, and meat saw are the necessary tools, and the equipment should include a substantial table. Perhaps the scalding table can be used.

Division of carcass. The carcass is divided into four main parts: the head, shoulder, hams, and middle.



National Livestock and Meat Board

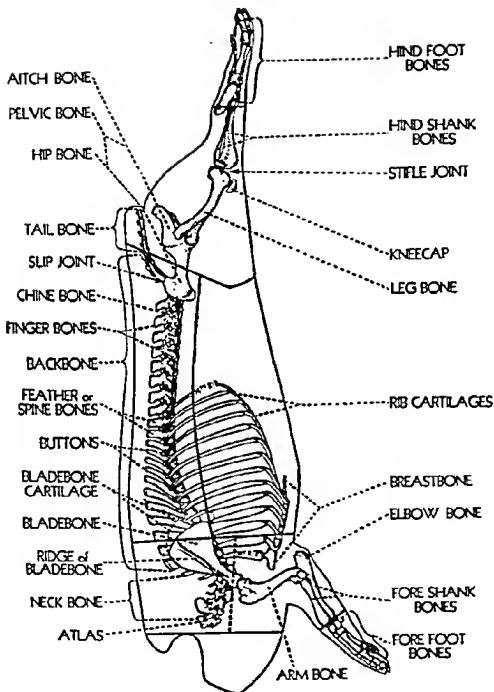
This pork chart shows the locations and names of the different wholesale cuts.

Head. The head is cut off at the atlas joint (where the neck bones join the skull), and trimmed as follows: Lay head with neck end down and cut jowls off. Trim them up squarely and put them in the cure with the rest of the meat. In one week they will be cured into excellent jowl bacon or pickled pork.

Shoulder. Cut the shoulder off across the third rib. Be careful in removing the neck bones and end of spareribs not to let the point of the knife run too deeply into the shoulder, or too much of the meat will have to be trimmed away in order to make a smooth cut. The shoulder can then be trimmed as nearly like a ham as possible and cured in that way if desired. The best way, however, especially with a large shoulder, is to cut the shoulder butt or top of the shoulder off, beginning at the point where the neck bone came out, and cutting on a line at straight angles to the shoulder proper. The lean portion left is known as the "Boston butt." It can also be sliced in chops and fried down or canned. Then trim off the corners of the shoulders and any wrinkles at the top of the shank. This is known as the picnic shoulder. It is sometimes called a California ham or "cala." Cut the foot off just above the knee at right angles to the shank and not at right angles to the shoulder itself.

Ham. Remove the ham by sawing on a line from a point between the fourth and fifth vertebra (counting toward the tail from the point where the backbone rises toward the tail) through a point about halfway between the pelvic and back bones. Always make this cut at right angles to the shank. To trim the ham, slip the knife under the tail bone and cut it out. With the shank in one hand, hold the ham, shank end up with the bone side or face toward you, trim off the fat on the back edge or cushion side of the ham in one smooth cut if possible. Then trim the fat from the face and flank side. Trim off all ragged pieces and rough edges, but expose as little lean meat as possible because salt hardens it.

Middle. The back and belly should be separated by cutting from a point just at the lower edge of the little tenderloin muscle, where the ham was cut off, to a point at the lower edge of the backbone at the shoulder end. Remove the layer of fat or fat back from the loin. Trim the spareribs from the belly, being



National Livestock and Meat Board

This pork chart shows the location, structure, and the names of bones.

careful to keep the point of the knife against the bone all the time so that it will not cut the bacon. Square edges of the side and use for bacon.

All trimmings should be used for sausage. All of the meat to be used fresh which is not to be used for a day or two should be frozen or slightly salted. The fat is to be rendered for lard.

Pork cuts and their uses. The U. S. Department of Agriculture has tabulated on the "Fresh Pork Chart" the following pork cuts and their uses.

PORK CUTS AND THEIR USES

CUT	CHARACTERISTICS OF CUT	USES
Feet.....	Bone, skin, not much meat, but this is delicate	Stews, boiling, frying, pickled
Hams.....	Solid meat, little bone	Fresh—steaks, roasts Smoked—baking, broiling, boiling
Fat back.....	Mostly fat, used for salt pork	Sauted, combined with other foods
Bacon.....	Fat and lean	Broiled, pan broiled
Loins.....	Tender lean meat	Roasts, chops
Pieie shoulder.....	Well-flavored, mostly lean meat	Fresh—roasted Smoked—cooked like ham
Butts	Cut from top of shoulder	Fresh—steaks, roasts May be cured like ham
Spareribs.....	Lean and fat, good flavor	Baked, broiled
Tenderloin.....	Lean, tender, no bone	Broiled, panbroiled, sauted, baked, braised
Fat.....	One-tenth to one-third hog carcass made into lard	Frying, shortening

EXTRA EDIBLE PARTS AND HOW PREPARED

Heart	Ears and snout
baked, braised	boiled, stewed
Kidney	Lungs
sauted, stewed	bake <i>en casserole</i>
Liver	Brains
sauted, baked	sauted, scrambled
Tongue	Jowl
boiled, braised	boiled
Tail	Head
boiled, braised	boiled for head cheese

Curing pork. There are two principal methods—the brine cure and the dry-salt cure.

The brine cure. This is also known as the sweet pickle or sugar cure. The common formula used on the farm is made up as follows: For each 100 pounds of meat use 10 pounds salt, 3 pounds brown sugar, 3 ounces saltpeter, 5 gallon water.

The pieces of meat to be cured are rubbed with the mixed ingredients. The remainder of the mixture is mixed with six gallons of boiled water. This is allowed to cool and is then poured over the meat that has been packed and weighted down in a suitable vessel. The vessel is kept in a cool, well-ventilated place. The ideal curing temperature is from 36 to 38° F. Above 40° F. there is danger of ham souring. Bacon requires about two days per pound, while hams and shoulders require three days per pound for curing, repacking at seven to twelve days. At this time the bacon is removed. Repacking insures a uniform and complete cure. There is no need to change the brine unless it is sour or ropy. When the cure is complete the pieces of meat are washed first in hot and then in cold water, allowed to dry for 24 hours and smoked.

The dry-salt cure. The following mixture is used in the dry cure: For each 100 pounds of meat use 8 pounds of salt, 3 pounds sugar (brown preferred), and 3 ounces saltpeter.

One-half of the mixture is rubbed on the meat and, at the end of seven days, the other half is rubbed on. At this time the pieces at the top should be put at the bottom of the vessel. The length of time for curing is the same in both processes and, when cured, the meat is handled in the same way.

Smoking meat. Cured meats are smoked for the purpose of improving their flavor and palatability. It also aids in the preservation of the meat. On most farms where hogs are slaughtered a small house is used as a smokehouse. Many commercial preparations are now on the market to be used in place of the smokehouse. These impart the smoked flavor and act as a preservative. Some of these products are inferior to others; consequently, expert advice should be obtained.

A smokehouse need not be a very extensive affair. In fact, a moveable house constructed of metal is quite satisfactory. A



This is the finished product, home-cured ham. The cut shows the method to be used when cutting slices from a ham.

smoking arrangement can be made of a barrel. One end of the barrel is removed and holes bored in the other end in which the strings of meat being smoked are put through. Dig a hole about three feet deep and from this extend a tile about one foot from the bottom of the barrel four or five feet away. This arrangement may be constructed on a bank with less labor. It is quite satisfactory for a small amount of meat. The meat should be smoked with a cool smoke until it is a

medium-brown color. Hardwood is preferred for smoking. However, corn cobs are quite satisfactory. Home-cured hams and bacon can be kept in good condition if protected from air and light, and hung in a dry place. Usually hams are wrapped in heavy paper and covered with a muslin bag. Burying in oats will cause the meat to have a musty smell after storage.

Making sausage. The trimmings from cutting the carcass are used for making sausage. Not over one-fourth of fat should be used in the making. This is ground thoroughly and mixed with salt, pepper, and other condiments to suit the taste. Usually about one-half pound of salt and slightly less than one ounce of pepper is needed for each one hundred pounds.

Freezing pork.¹ The widespread distribution of electric power and the development of so-called freezer-locker units

¹ U. S. Department of Agriculture, Farmers' Bulletin, 1186.

(often referred to as refrigerated lockers) have made subfreezing temperatures increasingly available to families interested in preserving farm-dressed pork. These units consist of individual compartments installed in a large room of a coldstorage plant. The compartments are made

with wire-mesh sides or some material allowing free circulation of cold air. The doors of the compartments are fitted with locks so that each person may keep his products under lock and key.

Freezing temperature is entirely practical for holding fresh pork though there are some definite limitations. The preserving effects of subfreezing temperatures include: (1) killing or stopping the development of molds, yeasts, and bacteria, (2) reducing the activity of the enzymes, thus delaying autolysis or self-digestion, and (3) retarding chemical changes such as dehydration and oxidation. Although there is little microbial action under freezer storage, the development of undesirable textures, colors, odors, and flavors is common. These changes are attributed to the continuing action of the enzymes, evaporation of the surface ice, and other actions.

Ten degrees below 0° F. is generally accepted as the preferred temperature for the "sharp" freezing of meat products. Although 0° F. is the recommended level for storing frozen meat, 10° F. is often used and should be satisfactory if the lower one is not practical. Temperatures above 10° F. are, in general, too high. Much variation in temperature is undesirable.

Chilled pork should be cut into family-size pieces and well wrapped in tough, moistureproof paper before freezing. Cheap oiled paper or ordinary wrapping paper will not prevent undesirable drying. Pork not properly wrapped will dehydrate or "freezer burn." The wrapped fresh meat should be spread so that it will freeze quickly. When the packages are piled together in locker it is often several days before the center of the pack



John Morrell and Company

These students are studying hog carcasses.



John Morrell and Company

Here is a meat-cuts identification contest for high school students.

reaches the desired temperature. Some trouble has been reported when the meat was piled to freeze.

Long storage periods sometimes result in undesirable drying of the exposed lean surfaces of frozen pork and the development of rancidity in the fat. Protecting the pork by proper wrapping and by proper temperatures will tend to

delay these developments although normally little trouble is encountered during the first month or so of storage. In general, farm families who use a freezer locker try to dress hogs periodically so that they can consume these limited quantities of frozen pork before it has been in storage more than three or four months. The fat of pork becomes rancid after long storage. Even with temperature constantly below zero pork should not be stored for more than six months.

Frozen pork is cooked with or without being thawed. Thawed or thawing pork is usually moist on the surface, thus affording ideal conditions for the growth of bacteria and mold. If the meat is to be thawed, it is desirable to thaw it in the refrigerator and to cook it promptly.

Rendering lard. Ordinarily the leaf fat, back fat, and fat trimmings are cooked together. The caul and ruffle fats from the internal organs yield a darker product than the other fats. If they have been removed carefully and washed and chilled promptly, they should have an acceptable odor and flavor.

Lard will render more rapidly and completely if the fat is cut into small pieces before being put into the kettle. Many persons prefer to grind it. Start cooking slowly with a small quantity of fat that can be stirred easily. When this fat has begun to melt add the remainder. The kettle should not be very full, or it may boil over. To prevent stocking and scorching, the fat should

be stirred frequently and fire watched during the entire cooking process.

At the beginning of the process, the temperature of rendering lard will be about 212° F. As the water contained in the fat tissues evaporates the temperature will rise slowly until it reaches 240° F. or 255° F. which is as high as it should be allowed to go.

As rendering proceeds, the residual tissues (cracklings) will brown and float. When they are more nearly completely rendered they will gradually sink to the bottom. Care should be taken at this time to prevent small particles of cracklings from adhering to and scorching on the bottom of the kettle. Many persons stop the cooking when the cracklings are still floating. The more nearly complete rendering, however, removes a greater proportion of the moisture, thus producing lard that will be more likely to keep.

It is advisable to allow the rendered lard to settle and cool slightly before emptying the kettle. The liquid lard may be siphoned or dipped carefully into containers. The rest of the lard, containing the cracklings, is usually put through a press, the lard being strained through a screen covered with two or three thicknesses of cheesecloth. If the hot lard can be put into five- or ten-pound containers and stored immediately at temperatures near or below freezing, it will chill rapidly enough to produce a fine grain.

Leaf fat will yield from 90 to 93 per cent of its weight in rendered lard; a combination of leaf fat, back fat, and cutting fat, from 80 to 85 per cent; and visceral fat, from 55 to 65 per cent. Well-pressed cracklings derived from skinless fat from an average kettle will constitute 4 to 6 per cent of the original weight of the fat.

Lard storing. Air and light may cause a chemical change in stored lard which results in rancidity. For this reason the containers should be filled as nearly to the top as possible, sealed with a tight cover, and stored in a dark, cool place. Once the lard has become rancid, it is impossible to improve it.

If the moisture has been eliminated from the lard by a

thorough rendering, no water-souring should develop during storage. The adding of a small quantity of commercial lard substitute will retard deterioration.

SUGGESTIONS FOR FURTHER STUDY

1. Attend a hog-killing and meat-cutting demonstration.
2. Determine from local farms the common methods used in the killing and dressing of hogs, and the cutting, curing, and smoking of pork.
3. Assist in slaughtering hogs and cutting pork on the farm.
4. Visit the local cold-storage locker plant to observe the slaughtering and cutting up and processing of hogs.
5. Visit a packing plant in your area to observe the slaughtering of hogs and the cutting and curing of pork.

REFERENCES

- BULL, SLEETER. *Meat for the Table*. McGraw-Hill Book Co., New York
- HELSEY, M. D. *Farm Meats*. The Macmillan Co., New York
- SPANGLER, A. J. and OTHERS. *A Handbook on Meats for Future Farmers*. Von Boeckmann-Jones Co., Austin, Texas
- United States Department of Agriculture:
- Cooking Cured Pork*. Leaflet, 81
- Pork on the Farm*. Farmers' Bulletin, 1186
- Pork in Preferred Ways*. Leaflet, 45
- ZIEGLER, P. THOMAS. *The Meat We Eat*. The Interstate Printers and Publishers, Danville, Illinois

CHAPTER 22

The Control of Diseases and Parasites

SWINE-LOT sanitation, known as the McLean County system, has been discussed in Chapter 8. This plan has helped materially in overcoming the rather heavy death loss in raising hogs. An estimated total of 30 per cent of pigs are lost by death in the period from farrowing until weaning time. A part of this loss is a result from crushing by the sow, yet common diseases claim a greater share, much of which is reduced by adequate sanitation.

The death loss from swine parasites or diseases is of course a tangible loss. However farmers suffer losses too from slow gains and increased feed costs. Also there is the loss from decreased value of affected stock. Swine parasites for example cause such losses. A recent release from the Bureau of Animal Industry of the U. S. Department of Agriculture indicated a loss in the Southeast of more than 50 cents per head for market hogs. This was from condemned parts due to parasitism in plants under Federal meat inspection.

Spraying the hog house for fly protection. Stable flies and hog lice can be controlled by the use of DDT. Wettable powder in a $\frac{1}{2}$ per cent solution is suitable for spraying the ceiling walls, floors, and bedding. It can also be applied to the hogs.

Essential points in swine sanitation. Attention to the following materially reduces the possibility of loss from disease:

1. Follow the clean-ground system of raising pigs by rotating pastures.

2. Use the pastures through the forage-crop season.

3. Provide houses that give ample space, shelter, and warmth.
4. Ventilate all of the houses properly, whether movable or central.
5. Clean the quarters frequently, removing all the filth and litter. Sprinkle dusty quarters with oil.
6. Disinfect the quarters frequently; if possible, open houses for sunlight exposure.
7. Divide the hogs into rather small groups, based upon size, age, and sex.
8. Be careful with shoats in the fall while on heavy feeds as they are susceptible to hog "flu."
9. Avoid muddy lots and wallows.
10. Quarantine for two weeks all hogs brought into the herd.
11. Isolate all hogs showing unusual symptoms.

Disinfection of swine quarters. Various disinfectants are available for disinfecting the swine quarters. A 2 per cent solution of liquor-cresol compound is highly efficacious. Chloride of lime, bichloride of mercury solution, and formaldehyde are also among the common disinfectants.

Whitewashing the swine quarters. In a clean-up campaign the hog houses are often whitewashed. The federal government formula for whitewash is as follows:

Slack a half bushel of rock lime in hot water. Cover to keep in steam. Strain and add one peck of salt dissolved in hot water. Add three pounds ground rice boiled to a paste and boiling hot, a half-pound Spanish whiting, and a pound of glue previously dissolved over a slow fire. Add five gallons hot water to the mixture and allow to stand in a covered vessel for a few days. Apply with brushes or spray.

Rations a factor in swine diseases. Changes of feed may bring about disturbances in the normal functioning of an animal. Pigs put on new corn, or on a heavy feed or rye, may scour until they become accustomed to the feed. These conditions are usually temporary and corrected by change of ration. Unbalanced rations lack the essentials for normal growth and thriftiness of an

animal, and frequently cause deficiency diseases. It is seldom that unbalanced rations are continued until disease results. Rickets in growing pigs and hairlessness in newborn pigs are due to this condition. *Rickets* can be prevented by a correct calcium and phosphorous balance in the ration, or the inclusion of vitamin D. (See Chapter 8.) Hairlessness of newborn pigs occurs in some of the northern sections of the country. It is due to a lack of the proper iodine content in the ration.

"Thumps" in young pigs has also been attributed to a lack of iron, and perhaps copper, in the ration (Chapter 8).

Observing the herd. A careful farm operator observes each animal in the herd daily. Perhaps the herd barn is seen to be rubbing a great deal. The herdsman investigates and discovers the animal is lousy. Perhaps a sow walks lame. An alert caretaker soon notices it and, if possible, eliminates the cause. Any variation from apparently normal condition is to be carefully scrutinized. Prompt attention very often prevents serious results, wide dissemination of contagious diseases or parasites, and possible losses. When unusual conditions are observed among the herd, an immediate investigation is warranted and, in case of doubt as to the difficulty, a veterinarian should be called.

Hog cholera. Cholera is one of our most serious diseases with swine. It is a highly contagious disease and annually causes very heavy losses. In some years the disease is of wider distribution and takes a higher toll than in others. The disease may be spread by visitors, by running water, by birds, by dogs, by vehicles, etc., and the possibility of the disease being spread by these agencies should be carefully guarded against during epidemics.

Symptoms of hog cholera. Usually the first sign or symptom of cholera noticed is one or more pigs "off feed." They may come to the trough but only nibble at their feed and then turn away. By the next feeding time they have lost their appetite but drink great quantities of water if it is available. Often a sick pig will not get up and come to feed and frequently will not rouse until forced to and then will move off a little way and stand with its flanks tucked up. The head is allowed to droop, the ears droop, and the tail hangs limp. The hair coat becomes rough and shabby in appearance. Great muscular weakness is shown



This pig is being vaccinated for hog cholera.

by a wabbling and staggering gait. The hind parts sway from one side to the other.

The temperature varies between 104.5° F. and 107.8° F. or 108° F. The fever usually lasts from four to seven days or longer. When death is coming on, the temperature will go below normal. The normal is 100.8° F. to 102.2° F. Temperatures taken in the anus of a pig in the incubative stages of cholera show a

gradual rise causing the pigs to consume much water.

Diarrhea is a usual symptom of hog cholera. During the course of the disease, constipation alternating with diarrhea is frequently found. The excretion is often dark in color, very watery in consistency, and has a very disagreeable odor.

In many cases a dry, hacking cough is noted. Coughing is not strikingly characteristic of hog cholera. Many hogs die before any particular cholera symptoms are noticed.

Methods of immunizing against cholera. In administering the simultaneous inoculation the serum is injected under the skin, in the groove or pit of the hind leg, the animal being held on his back. The virus is injected in the same manner but on the opposite side. The virus, of course, is given in a very small dose as compared with the serum. The doses for simultaneous inoculation are indicated in the following table:

TABLE 66. DOSES FOR INOCULATION FOR HOG CHOLERA

WEIGHT OF HOGS	DOSE OF SERUM	DOSE OF VIRUS
Below 10 pounds	10 cc.	2 cc.
10 to 15 pounds	15 cc.	2 cc.
20 to 30 pounds	20 to 25 cc.	2 cc.
40 to 75 pounds	30 cc.	2 cc.
100 to 150 pounds	40 to 60 cc.	2 cc.
175 and over	80 cc.	2 cc.

If the herd is infected, the dose of serum should be slightly increased for all apparently healthy hogs, and all those showing high temperature or other evidences of disease should receive at least a dose and a half of serum and no virus.

Use good serum, and give plenty of it. Enough serum should be given to prevent any signs of illness in treated hogs. Give as much or more than directed. This treatment should be handled only by competent veterinarians, or by skilled laymen who have had adequate training in its use.

The prolonged immunity caused by the simultaneous inoculation is much to be desired for several reasons. It prevents the recurrence of cholera in the treated hogs; it eliminates the additional expense of re-treatment; and, in the case in infected premises, it affords a better opportunity to eliminate the germs of the disease, thus removing a source of danger from the neighborhood.

Hog cholera vaccine. A system of immunizing hogs against hog cholera without using the living virus is necessary if we are ever to completely control this disease. In an effort to do this two products have been developed and are on the market. One is known as crystal-violet vaccine and the other B.T.V. or tissue vaccine.

Crystal-violet vaccine is made by treating the blood of pigs in well-advanced stages of hog cholera with crystal-violet dye.

Tissue vaccine consists of finely ground tissues of pigs in well-advanced stages of hog cholera treated with oil of eucalyptus.

In both methods the aim is to destroy the disease-producing qualities of the virus without disturbing the immunizing powers of the product. Because they have no curative powers against hog cholera they positively must not be used on hogs already infected with the disease or even on those recently exposed to hog cholera.

According to some authorities the immunity which these vaccines do produce develops rather slowly and is of relatively short duration as compared to that produced by the serum-virus method of immunization.

Tuberculosis.¹ Tuberculosis is an infectious disease, common to both domestic animals and man. It is slow in its development

¹ U. S. Department of Agriculture, *Farmers' Bulletin*, 1214.

and is hard to recognize until the later stages, except through the application of the tuberculin test. In hogs tuberculosis is not likely to be mistaken for hog cholera unless the tuberculosis has progressed to an advanced stage.

Symptoms. Tuberculosis, though it may have existed in a herd for a considerable period, is difficult to detect by clinical examination. There is rarely any elevation of temperature. The appetite, as a rule, is not impaired in the early stages of the disease. Later, however, the hogs affected lose their appetite, and this, coupled with the wasting nature of the disease, causes the animals to become weak and emaciated. If the lungs are involved, there is frequent coughing, while lesions of the intestines may produce more or less diarrhea. In advanced cases the temperature is sometimes below normal, and the ailment then somewhat resembles chronic hog cholera. However, there is no congestion of the visible mucous membranes and no gummy exudate from the eyelids. While the animals are slow in moving about, there is not the staggering gait seen in chronic cholera.

Treatment. Prevention is the main thought in the fight against tuberculosis. Since hogs usually contract the disease through feeding on skim milk from tubercular cows or in following tubercular cattle in the feed-lot, there is no better preventive measure than to have a tubercular-free herd of cattle. All skim-milk fed should be heated sufficiently (145° F. for 30 minutes) to kill the germs of tuberculosis.

The tuberculin test is being used successfully in detecting tuberculosis in swine, the intradermal test being preferable. The reactors should be segregated and handled according to official agreement, if such exists. If the animals are marketed for slaughter they should be shipped under proper regulations to a slaughter house where slaughtering is done under the supervision of federal inspectors. Hogs known to be affected with tuberculosis should not be sold to local butchers.

Vehicles of infection. The possibility of swine becoming infected by a direct contact is indeed very small, and as a general rule the virulent materials find their way to the feed or other substances in the environment by means of which they may be taken into the body. Milk of tuberculous cows always has been

an important vehicle by which tuberculosis can be introduced into a herd of hogs.

The discharges from the bowels, the lungs, or other parts of the body of infected cattle, poultry, or even swine scattered in stables and yards in which swine are apt to pick up their food are common means by which the infection is carried from animal to animal and even from place to place.

Carcasses of animals, especially of cattle, poultry, and swine themselves, as well as various types of slaughter-house wastes fed in the raw state, are likewise frequent means for the conveyance of tuberculosis infection. Table wastes and garbage may serve as a vehicles for the human tubercle bacillus in its transmission to hogs.

Hog "flu" (swine influenza, infectious bronchitis).¹ "Flu" is a disease of swine which appears widespread, particularly in sections where hogs are raised in large numbers. It is a herd disease, attacking a large percentage of the animals at the same time. The thrifty, growing hogs seem to be more susceptible than the poorly fed and unthrifty ones. The causative agent of "flu" is unknown. While a sudden change of feed such as from pasture to a heavy ration rich in protein has been attributed as a factor, a study of the disease has failed to substantiate this theory.

Symptoms. Swine "flu" is characterized by the sudden prostration of a large portion of the herd. There is complete loss of appetite. Spasmodic breathing, or thumps, is one of the first symptoms noted. When urged to move, the animals have violent fits of coughing. The eyes are red, swollen, and weeping. There may be a discharge from the nose, often streaked with blood. Occasionally a hog will vomit stringy mucus tinged with bile. The temperature in typical outbreaks ranges from 101° F. to 108° F. and usually drops to 103° F. to 104° F. in about a week, when, if the hogs survive, they are usually back on feed.

Treatment. The treatment for swine "flu" is almost entirely hygienic. Place the animals in warm, clean, well-bedded quarters, with plenty of fresh air, and provide plenty of fresh drinking water. Give little feed or none at all for 24 hours.

¹ U. S. Department of Agriculture, Farmers' Bulletin, 1211.

Necrotic enteritis (Necro-bacillosis).¹ Necrotic enteritis is a chronic inflammation of the intestines which impairs the digestion to a serious degree, stunts the growth of the animal, and often proves fatal. This is commonly known as "necro." It is a chronic form of salmonella choleraesuis infection.

Pigs fed rations mostly of corn may develop symptoms which appear similar to those of necrotic enteritis in four to six weeks. (See Chapter 13.) This is due to a lack of proper protein and vitamin-B complex particularly nicotinic acid or niacin. It is known as pig pellagra. To prevent this type of enteritis it is recommended that the ration contain a liberal quantity of good quality protein and if pasture is not available 10 per cent of green leafy alfalfa hay be included in the ration. The following mixture of feed is suggested for pigs with necrotic enteritis for a two- to four-week period.

RATION FOR PIGS WITH NECROTIC ENTERITIS

Ground corn	20
Ground oats	30
Wheat middlings	30
Dehydrated alfalfa meal	10
Meat and bone meal	4
Soybean oil meal	5
Complex mineral mixture	1
Plus vitamin D, B complex, and aureomycin supplements	

Symptoms. Necrotic enteritis is usually confined to pigs and shoats, rarely affecting the older hogs in the herd, and may show in a number of young animals at the same time. In the early state the appetite is not badly impaired, but as a rule there is a profuse diarrhea. As the disease progresses the pigs eat sparingly, become potbellied, unthrifty, thin, and weak. The skin is dry and scurfy. While these symptoms are somewhat like those of hog cholera, the absence of fever and the fact that no red spots appear in the usual locations on the skin differentiate the ailment from cholera.

¹ U S Department of Agriculture. Farmers Bulletin, 1244

Treatment. To be effective, treatment should be applied before the disease has progressed. Rough feed and so-called stock food and tonics that may contain irritating ingredients should be avoided. Put the animals affected in pasture if such is available. A physic of some kind, such as Epsom or Glauber salt, or linseed oil, is recommended. The following mixture has been used and found of some benefit as a treatment:

Copper sulfate.....	..	..	1 part
Hyposulfite of soda.....	..	..	4 parts
Charcoal.....	..	..	2 parts
Common salt.....	..	..	6 parts

Give one heaping teaspoonful of this mixture to every 100 pounds of live weight, in slop or milk, night and morning for about a week. Care should be taken that the copper sulfate is well pulverized and thoroughly mixed with the other ingredients. The pulverized copper sulfate alone may be added to the drinking water in proportion of 1 ounce to 25 gallons of water.

Infectious abortion. Infectious abortion¹ or Brucellosis abortion is the expulsion of the developing embryo from the uterus before the end of the gestation period. Infected pregnant sows do not always abort. Blood tests can be used to detect the disease. Abortion may be brought about through exposure to severe cold weather, injuries, crowding, or rough handling. It may occur as a result of poisoning as a sequel of and in the course of an infectious disease. Infectious abortion is caused by a specific organism which invades the genital organs.

Symptoms. The symptoms of pending abortion vary according to the period the animal has been pregnant. In the advanced stage of gestation the sow in which abortion is threatened goes off feed, is restless, shivers, has muscular tremblings, and at times may experience labor pains. Bleeding from the genitals may occur, although this is not a constant symptom. After a time the delivery of dead pigs will come about. It is quite common in aborting sows to have a discharge from the uterus resulting from infection.

¹ U. S. Department of Agriculture. Farmers' Bulletin, 1244.

Treatment. Proper care of pregnant sows does much to eliminate the danger of abortion. Pregnant animals should be protected from injuries and exposure to bad weather. They should have plenty of exercise and not be placed in crowded pens or shelters. Feeding has much to do with the general health of the pregnant sow, which in turn has a decided influence on gestation. When signs of abortion are noted the sow should at once be taken away from the rest of the herd and placed in a clean, comfortable shelter, preferably a box stall. If the pigs are dead and cannot be expelled in the natural way, they should be removed with instruments, care being taken also to remove all of the afterbirth from the uterus. The parts should be washed out with a warm normal salt solution. The diet should consist of soft liquid rations, such as mashies, milk, and clean slops. A dose of calomel may be given to keep the liver active. If there is a discharge from the uterus of the aborting sow, douching with permanganate of potash, one ounce to the gallon of water, or a 2 per cent solution of lysol, repeated once a day, usually proves very beneficial. It is always well to consult a veterinarian.

The swine type of Brucellosis may be transmitted to cattle. However, the cattle type seldom occurs in swine. Humans can contract the disease so care should be taken in handling herds that are infected.

The best method of control is to test the herd periodically and remove all the suspicious individuals.

Scours or diarrhea in pigs.¹ Scours is a very serious ailment of pigs which takes a heavy toll each year from the new litters. This condition is frequently associated with anemia, and with mineral and vitamin deficiencies. Further, the condition may result either from improper care of both the sows and pigs, or it may be caused by infection in the sow previous to or during pregnancy. The disease may appear in pigs at an age varying from 1 day to several weeks. When it attacks a pig a day or two old, faulty care and feeding of the mother may be the responsible factors. Overfeeding the sow, improper feeding of the sow (as with garbage containing washing powders and other chemicals

¹ U. S. Department of Agriculture, Farmers' Bulletin, 1244.

that may be secreted in the sow's milk), unsanitary environment, poor housing, and improper care of the sow, all serve to lower the natural resistance of the young animals and make them susceptible to the disease.

Symptoms and prevention. The chief symptom of diarrhea is constipation, followed by a profuse diarrhea. The discharge from the bowels is of

in color, and of a very

impaired, but in a few days the pigs affected stop eating or nursing and soon begin to lose strength and flesh. The coat becomes rough and scurfy, and the little pig squeals with pain when handled.

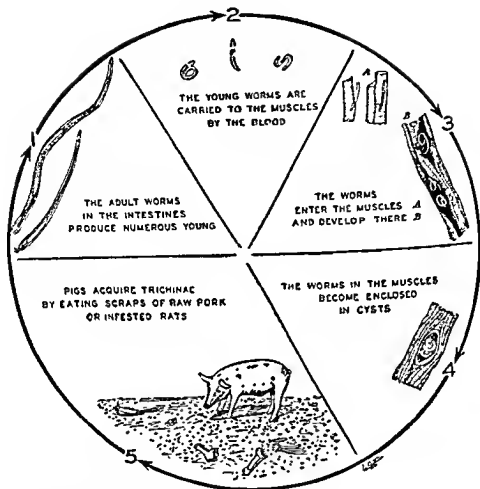
As the majority of cases are caused by dietary disturbances, the first step in preventing the disease is to see that the sow is getting the right kind and quantity of feed. Do not overfeed the sow during the first ten days after farrowing. Also do not breed a sow or gilt just recovering or recently recovered from an infectious disease.

If scours sets in when the pig is but a few days old the ailment is nearly always fatal. The nursing sow should be kept in a clean, warm, comfortable pen or shelter where, with her litter, she will have plenty of room, fresh air, and sunshine. Change the bedding daily until scouring ceases. Consult a veterinarian concerning medicinal treatment.

Swine Erysipelas. Swine Erysipelas is more or less frequent in the swine raising areas of the United States. It is quite widespread in European countries and vaccination protection is used to control the disease much the same way as hog cholera is controlled in the United States. There are two recognizable forms of the disease, the acute in which skin symptoms are characteristic and the chronic form in which lameness because of arthritis and heart lesions is common.

Pigs vary in their resistance to the disease. Also, there appears to be a variation in the virulence or strength of the disease organisms. The disease is more prevalent in the warm season of the year or the third quarter at which time mortalities are also the highest.

This disease may be transmitted to man, the organism gaining



U. S. Department of Agriculture

Can you follow the life cycle of the trichina worm in this chart?

entrance to the body through wounds or abrasions of the skin. A veterinarian should be called immediately if this disease is suspected in the swine herd. Medicinal treatment is worthless and control must be made by immunization and sanitation.

Trichinosis. Trichinosis is a disease which infects humans as well as swine and other animals. The common source of the disease to humans is insufficiently cooked pork. Pork, should be cooked until it is well done to be safe. Garbage-fed hogs are more apt to be infected than those not fed on garbage. But even in

nongarbage-fed hogs about 1 per cent are usually infected with trichinea. Over 6 per cent of garbage hogs are infected. About 10 per cent of our hogs are fed some garbage.

Rats play an important part in the continuance of the disease. Cooking of garbage for swine feeding would go a long ways in reducing trichinae in swine. Other precautionary measures are: (1) Do not feed kitchen scraps containing raw pork. (2) Do not throw dead rats or mice in the hog pens. (3) Animals that have died on the farm should be buried deep in quick lime or burned.

Swine worms. One of the greatest causes of loss of profit in swine raising is the presence of various kinds of worms. These include lungworms, common roundworms, thorn-headed worms, stomach worms, whipworms, pinworms, and kidney worms. A few of the common worms are discussed in the following paragraphs.

Lungworms. Lungworms are usually 1 to 1½ inches in length, and threadlike in diameter. The disease is quite generally distributed and may cause considerable loss and unthriftiness among pigs when conditions are favorable for its development. These worms live in the tubes of the lungs where they deposit eggs, which are expelled by coughing. These eggs hatch in the bronchial tubes or on the way out after being coughed up and swallowed, and further develop on reaching the outside of the body, but only in the presence of moisture. When dry, well-drained lots are provided, their development is retarded and little or no trouble occurs.

Symptoms. Pigs show that they have lungworms by a spasmodic coughing at times accompanied by a white frothy discharge from the nose and a general unthriftiness. Positive diagnosis only made by a post-mortem examination where cross sections of the lungs exposes the white threadlike worm in the air tubes.

Treatment. The treatment of lungworm is practically useless but preventive measures as outlined above will be well rewarded.

Stomach worms. Stomach worms are two small worms often found in the stomach of swine which, no doubt, are responsible

for considerable damage. The development of these worms from the egg to adult is not yet understood, but since the eggs are well developed in the uterus of the mature female it is believed that they develop without an intermediate host.

Preventive measures. With little knowledge of the life history no special recommendations can be made for control, but when hogs suffer loss of appetite, fail to fatten on good rations, or give evidence of stomach irritation, examination should be made to determine the presence of these parasites. Pigs from herds where the infestation has been found should be suspected and should be isolated. The manure from these pens should be mixed with quicklime or spread on fields where pigs will not run. Keep healthy hogs from these pens until they have been cleaned as thoroughly as it is possible to clean them.

Common roundworm. Of all the parasites that hinder the development of the pigs the large round white worms of the intestine are the most common and probably the most injurious. These worms disturb digestion and stunt growth, especially of little pigs, but the manner in which this is accomplished was not fully understood until recently. Most men assumed that the worm absorbed feed that the pig needed as it lived in the intestine, and in addition, sucked blood. Scientific study of the life history of this worm has been completed and is extremely interesting. The results of this study have shown a very logical, cheap, and effective method of preventing the worms from getting to the pigs.

How worms reach pigs. The beginning of each worm is an egg, which is so small that it cannot be seen except by the aid of a microscope. A mature female worm may produce several million eggs during her lifetime with the droppings and infect the soil. If the weather is favorable a small embryo or tiny worm develops in the egg in a few weeks and is ready to be swallowed by a host animal. Should weather be unfavorable, the egg can for a long time resist cold, drought, many chemicals or so-called disinfectants. Records indicate that at least one in three hogs of breeding age is infected with some of these worms under the present conditions of handling and management. This means that most hog lots have soil that is infested with the eggs of this

worm, and it is therefore easy to see why so many young pigs become infested and also why even children in some localities suffer.

When a pig eats feed contaminated with soil carrying worms, the eggs reach the stomach. Suckling pigs also acquire many worm eggs as they suckle the skin of a sow that has been soiled with dust or mud of an infested pen or yard.

Development. While still too small to be seen, except with the aid of a microscope, the larvae enter the blood stream and reach the liver, then pass to the heart and are pumped out into the lungs. In the lungs they undergo considerable development in size and collect in clumps or patches, mostly in the lower forward part of the lung. After several days of development in the lung tissue each one works its way into an air tube and migrates toward the large bronchial tubes and the wind pipe, to be coughed up and swallowed. This journey through the lung consumes about ten days on the average, and the now small worm reaches the intestine and begins its growth and development to full maturity, which takes perhaps 60 days or more. When full grown it may be anywhere from six to eight inches or a foot in length.

If the intestine is crowded, some worms may pass up into the bile ducts of the liver and cause disarrangement of that organ. These adult worms soon begin to produce eggs and the life cycle goes on all over again.

Since it is known that the larva spends a certain stage of its existence in the lung tissue and emerges finally in a larger stage into the air passages, it is now easy to understand the coughing and "thumpy" breathing which farmers long ago connected with "wormy" pigs.

In view of the fact that these eggs can and do resist extremes of cold and drouth for a long time, and considering how many generations of swine a farmer tries to raise on one small lot and that most pigs are compelled to eat feed and drink water soiled with barnyard mud and filth, it is not remarkable that so many are infected.

Treatment. The surest method of eliminating worms from the herd is by a system of management which prevents the

for considerable damage. The development of these worms from the egg to adult is not yet understood, but since the eggs are well developed in the uterus of the mature female it is believed that they develop without an intermediate host.

Preventive measures. With little knowledge of the life history no special recommendations can be made for control, but when hogs suffer loss of appetite, fail to fatten on good rations, or give evidence of stomach irritation, examination should be made to determine the presence of these parasites. Pigs from herds where the infestation has been found should be suspected and should be isolated. The manure from these pens should be mixed with quicklime or spread on fields where pigs will not run. Keep healthy hogs from these pens until they have been cleaned as thoroughly as it is possible to clean them.

Common roundworm. Of all the parasites that hinder the development of the pigs the large round white worms of the intestine are the most common and probably the most injurious. These worms disturb digestion and stunt growth, especially of little pigs, but the manner in which this is accomplished was not fully understood until recently. Most men assumed that the worm absorbed feed that the pig needed as it lived in the intestine, and in addition, sucked blood. Scientific study of the life history of this worm has been completed and is extremely interesting. The results of this study have shown a very logical, cheap, and effective method of preventing the worms from getting to the pigs.

How worms reach pigs. The beginning of each worm is an egg, which is so small that it cannot be seen except by the aid of a microscope. A mature female worm may produce several million eggs during her lifetime with the droppings and infect the soil. If the weather is favorable a small embryo or tiny worm develops in the egg in a few weeks and is ready to be swallowed by a host animal. Should weather be unfavorable, the egg can for a long time resist cold, drought, many chemicals or so-called disinfectants. Records indicate that at least one in three hogs of breeding age is infected with some of these worms under the present conditions of handling and management. This means that most hog lots have soil that is infested with the eggs of this

worm, and it is therefore easy to see why so many young pigs become infested and also why even children in some localities suffer.

When a pig eats feed contaminated with soil carrying worms, the eggs reach the stomach. Suckling pigs also acquire many worm eggs as they suckle the skin of a sow that has been soiled with dust or mud of an infested pen or yard.

Development. While still too small to be seen, except with the aid of a microscope, the larvae enter the blood stream and reach the liver, then pass to the heart and are pumped out into the lungs. In the lungs they undergo considerable development in size and collect in clumps or patches, mostly in the lower forward part of the lung. After several days of development in the lung tissue each one works its way into an air tube and migrates toward the large bronchial tubes and the wind pipe, to be coughed up and swallowed. This journey through the lung consumes about ten days on the average, and the now small worm reaches the intestine and begins its growth and development to full maturity, which takes perhaps 60 days or more. When full grown it may be anywhere from six to eight inches or a foot in length.

If the intestine is crowded, some worms may pass up into the bile ducts of the liver and cause disarrangement of that organ. These adult worms soon begin to produce eggs and the life cycle goes on all over again.

Since it is known that the larva spends a certain stage of its existence in the lung tissue and emerges finally in a larger stage into the air passages, it is now easy to understand the coughing and "thumpy" breathing which farmers long ago connected with "wormy" pigs.

In view of the fact that these eggs can and do resist extremes of cold and drouth for a long time, and considering how many generations of swine a farmer tries to raise on one small band that most pigs are compelled to eat feed and drink water mixed with barnyard mud and filth, it is not remarkable that many are infected.

Treatment. The surest method of eliminating worms from the herd is by a system of management which prevents the

worms from reaching the pigs. When they are known to be infested with worms it is usually advisable to give them a vermifuge. This is best given when the pigs are of 40 to 60 pounds weight. Big shoats and old hogs seldom heed this treatment. Many preparations have been recommended and a good many methods suggested for giving the dose.

Santonin, though high in price, is generally conceded to be a good drug to use and the capsule method is in wide use to make sure that each pig receives the dose intended for him. The attempt of the amateur to administer capsules and tablets to pigs has often resulted in death to the pig from puncture of the pharynx. For these reasons the administration of vermifuges is best left to the properly equipped and experienced layman or veterinarian. The dose is three grains to a 50-pound pig. Fast a pig a day before dosing and for about as long thereafter, so that feed will not dilute the action of the drug too much. A purge is always given with the vermifuge and when the purge has acted, get the pigs away to clean ground, preferably pastures, so that they will not be infested again.

Oil of chenopodium is now widely recommended as a vermifuge. This oil must always be mixed well with castor oil as it is somewhat irritable when given alone. A common mixture is made as follows: Castor oil, 128 ounces; oil chenopodium, 8 ounces; chloroform, 8 ounces. Pigs are fasted for 24 to 36 hours. A dose of one ounce is given to a pig weighing 50 to 60 pounds. There are several commercial worm remedies on the market. The trained man equipped with a stomach tube can administer the dose direct to the stomach in a manner which overcomes most of the objections to the use of this drug, thus insuring greater safety to the pig.

Phenothiazine has been found to be less effective with swine than chenopodium or sodium fluoride.

Sodium fluoride is the most recently developed vermifuge. It is the most dependable treatment removing about 95 per cent of the parasites, particularly roundworms, when properly administered. Apparently it is ineffective with thorny headed worms. The recommendations from the U. S. Department of Agriculture on the administering of sodium fluoride follows:

The best treatment consists in feeding for one day a mixture of one part by weight of technical-grade sodium fluoride to 99 parts of dry ground feed. Do not fast the animals before treatment but slightly underfeed them 24 hours before they are to be treated. On the day of treatment the medicated feed is given in the morning in about the amount that they will clean up in one day. Next morning if any medicated feed is left mix it thoroughly with the next day's feed and continue the customary feeding from then on. No cathartic need follow this treatment. It should be pointed out that some stations advocate feeding for one day only, also that pigs given feed with 2 per cent sodium fluoride will become very sick after a heavy feed. About five pounds of the medicated feed is sufficient per pig.

Depending on the feeding space available the pigs should be divided into groups of not to exceed 30 of about equal size to insure fair distribution of the medicated feed to all individuals. It is suggested that pigs subject to the chance of roundworm infestation be given two treatments of this drug. One when they are eight to twelve weeks old and a later one when they are four to six months of age. The treatment does not effect the tissues of the animal. Sodium fluoride should not be fed to piggy sows or pigs with intestinal disturbances. *It should be fed dry.*

This drug is poisonous to man and animals. The technical grade also sometimes called the chemically-pure grade, the kind



These two pigs are litter mates. The larger pig which has been treated with sodium fluoride for internal worms and sprayed with benzene hexochloride for mange weighs 100 pounds. The smaller pig weighs 32 pounds. This pig has not been treated.

ordinarily for sale to the public, is usually tinted with color to avoid confusing it with salt or sugar.

Containers carrying sodium fluoride should be plainly labeled poison and kept out of reach of children and all animals.

External parasites. Hog lice and common mange are the most widespread of external parasitic enemies of swine. Both are controlled by the same methods. The discount of mangy hogs on the markets has brought the producer to the realization that his profits from the pork enterprise would be greatly reduced if mange were not controlled. In some of the slaughtering centers 40 per cent of the hogs marketed showed evidence of mange infestation. The estimated loss to farmers from the presence of mange on hogs marketed has been expressed in millions of dollars.

Mangy hogs are discounted because the parasite affects certain parts of the hog which are of greatest value. A dockage rate of from 50 cents to \$1.50 per hundredweight, depending upon the severity and extent of the mange, is common in mangy droves. The hams, bacons, and shoulders are lower in their value because of the roughened skins, hence the lower price for the hogs. Attractiveness is demanded by the purchaser of meats. Pork with thick, heavy, roughened skin is not desired in the trade, and if very noticeable, the hide is removed before marketing; consequently the packer must buy them at a discount.

The rapidity of gain and the efficiency of gain is affected by the mange mites which burrow under the outer layers of the skin. The condition spreads rapidly because the mites reproduce in 12 to 14 days' time. The discomfort causes the pig to rub on the posts, fences, or other convenient places. This spreads the parasites and very soon they become widespread in the herd and cause a slowing of the gains, or, if quite severe, a loss of flesh on the hogs.

The control of mange and lice is far more difficult during winter months, because it is not advisable or practical to dip the pigs or to use crude oil extensively. This accounts for its greater prevalence in hogs marketed during the latter part of the winter. Healthy hogs seldom become infected during the

summer months while on pasture. The sanitary conditions which prevail on pasture feeding materially reduce the extent of mange. The parasite spreads quickly among undeveloped, unthrifty pigs confined to small lots in filthy surroundings.

As common mange spreads rapidly, separation is advisable if the condition is noted, before the entire herd becomes infested. Prompt treatment in the early stages curtails the distribution and eliminates the offending mites. Several methods are used for the application of the material which destroys the mites.

Dipping, spraying, and washing can be used advantageously, depending upon circumstances and equipment. If wallows are a part of the equipment, the mite-destroying solution or oil can be placed in the wallow. Frequent and thorough application every two weeks will subdue the pest.

The lime-sulfur treatment is economical and may be applied effectively in various ways. Dipping is the most effective but when this method is not practical because of weather conditions, or the equipment is not available, spraying or hand applications are suggested. The solution may be sprinkled or sprayed on the backs and sides of the hogs and then spread over the entire surface with a brush or rag. The effectiveness depends upon the thoroughness of the job. The use of a dipping vat is the most effective method of applying lime-sulfur or any other vermin-extermimating liquid. The hog wallow has a shorter period of usefulness than the dipping vat and in general practice is not so effective. The lime-sulfur solution which is the same as that solution used for spraying orchards is mixed for hog dipping in the proportions of about one gallon of the solution to 25 gallons of warm water. The dry form of lime-sulfur is more convenient to use but is usually regarded as not quite so effective. Two pounds of the dry form are equal to one gallon of the liquid. It is generally recommended to mix one pound of dry lime-sulfur to ten gallons of water for swine dipping.

Waste crank-case oil and crude oil have proved their worth in controlling common mange and lice. One per cent of liquid cresol compound mixed with the waste oil adds to its efficiency in this role. Hand applications or spraying are the most common methods of treatment. However, oils can be used in hog wallows

and in conjunction with a dipping solution, in a vat. Hog oilers and rubbing posts are of some value but few of them give a wide distribution of the oil. Hogs that have been oiled should be handled carefully. Do not expose them to extreme cold, to bright sunshine, or move them about rapidly, as injury to them may result.

Benzene hexachloride treatment has proven to be very effective in mange control. Many of the proprietary products for skin treatment of swine contain this material.

The advantage of benzene hexachloride is that one treatment will control most cases of common mange. It is used either as a spray or a dip. Wettable powder of benzene hexachloride mixed at the concentration to give one quarter of 1 per cent gamma isomer in water is effective. Commercially packed products indicate the proportion that should be mixed with water to secure the right concentration. Dipping is more effective than spraying when complete coverage is not accomplished.

Some forms of benzene hexachloride have a disagreeable musty odor. Some other equally effective forms are practically odorless. There is no evidence that its use will affect the pork produced from slaughter pigs. It can be used with safety with breeding stock and market stock prior to marketing. *Lindane* is odorless, pure gamma isomer benzene hexachloride.

This method treatment is efficient with common or sarcoptic mange and lice, and also probably effective with the rarer demodectic mange.

Chlordane treatment consists of an emulsion of 0.25 per cent chlordane, and it has been found to be effective in the control of sarcoptic mange in swine. It is free from an objectionable odor and it will not harm hogs when properly formulated and applied. However some pigs have been harmed by this material.

Lice are readily controlled by dipping, spraying, and washing with the materials used for mange. While these applications are being given they may be the means of suppressing a mange outbreak, which has not attracted the attention of the owner or attendant of the herd.

Administering medicines to pigs. *Mixing with feed.* Many medicines can be given with some soft feed like wet middlings.



Keystone Steel and Wire Company

This is a decentralized hog-raising layout. Prevention of diseases and parasites can be best accomplished by getting the pigs out on clean ground. Note the housing, feeding, watering, and fencing equipment.

Occasionally certain medicines can be given through the drinking water. The difficulty with this method is that it can be used only with medicines that are agreeable, and then too, there is likely to be a waste and a definite dosage is by no means assured.

Capsule method. The capsule method has certain advantages. A definite dosage is assured, and it is easily given. A jaw spreader and a balling gun are commonly used.

Drenching. The drenching method should be used by those expert in handling swine. Animals with disease of the respiratory tract should not be drenched. The medicine should be given very slowly, allowing the pig ample time to swallow each mouthful.

SUGGESTIONS FOR FURTHER STUDY

1. Visit local farms to make inquiry as to the extent of parasitism and disease in swine. Make a list of the common diseases.
2. Arrange for a talk by your local veterinarian about swine diseases and parasites, their prevention and control.

3. Plan a demonstration on some farm on the control of external parasites, lice, and mange.
4. Determine what provisions are made in your locality for the control of flies. Arrange for a demonstration for the spraying of a farmstead for fly control.
5. Assist in a clean-up and disinfecting of a swine farm and the swine equipment.
6. Help in the vaccination of a lot of pigs for hog cholera.
7. Help in treating a lot of pigs for worms.

REFERENCES

- DYKSTRA, R. R. *Animal Sanitation and Disease Control*. Interstate Printers and Publishers, Danville, Illinois
- United States Department of Agriculture:
- Control of hog lice*. Leaflet, 316
- Controlling Lungworms in Swine*. Leaflet, 118
- Diseases of Swine*. Farmers' Bulletin, 1914
- Electric Brooding Saves Pigs, Saves Lambs, Saves Feed*. Farmers' Bulletin, 2039
- Hog Cholera*. Farmers' Bulletin, 834
- Hog Lice and Hog Mange*. Farmers' Bulletin, 1085
- Internal Parasites of Swine*. Farmers' Bulletin, 1787
- Keeping Livestock Healthy*, Yearbook of Agriculture
- The Prevention of Roundworm in Pigs*. Leaflet, 5
- Trichinosis*. Leaflet, 34

Appendix

TABLE 67. NUMBERS OF HOGS IN SELECTED COUNTRIES.
Food and Agriculture Organization of the United Nations, Commodity Series No 3, January, 1940

COUNTRY	DATE, ENUMERATION	1934-38	1940 (Thou- sand head)	1941 (Thou- sand head)	1942	1943	1944	1945	1946
United Kingdom ..	1-4 June	4,610	4,106	2,558	2,143	1,829	1,867	2,152	1,955
Ireland ..	1 June	1,968	1,049	764	519	434	381	426	479
France ..	1 November	7,084	4,978	5,011	4,644	3,911	3,667	4,386	5,278
Belgium ..	31 December	1,086	633	444	526	485	635	735	776
Netherlands	December	1,595	1,186	720	688	846	600	981	1,062
Switzerland	21 April	966	959	764	670	629	600	698	654
Norway ..	April	449	1,362	246	192	125	188	172	235
Sweden ..	1 June	1,348	1,315	1,001	845	987	1,054	1,079	1,165
Finland ..	1 March	434	337	252	200	235	335	222	254
Denmark ..	June-July	3,300	3,269	1,815	1,211	2,083	2,084	1,646	1,768
Germany ..	December	18,239	16,687	14,011	11,576	12,823	12,293	7,136	8,407
Austria ..	December	2,848	2,190	2,044	1,772	1,872	1,697	1,030	1,494
Poland ..	30 June	9,684	9,684	3,071	2,933	3,256	3,097	1,697	2,674
Czechoslovakia ..	31 December	3,158	2,766	3,071	2,933	3,256	3,097	2,359	2,914
Italy ..	July	2,980	4,520	3,603	3,672	3,285	3,067	3,036	3,000
Spain ..	1 July	6,942	5,611	....	4,973	....	....	....	....
Portugal ..	31 December	1,177	1,177	....	....	....	....	....	....
Greece ..	30 November	542	1,362	....	....	....	280	330	4400
Yugoslavia ..	31 December	3,138	3,504	....	....	....	....	1,497	2,733
Rumania ..	31 December	2,440	1,770	1,655	2,001	1,906	....	1,020	....
Hungary ..	Feb./March	4,000	4,390	3,949	4,670	....	....	1,114	1,327
Bulgaria ..	August-Sept.	1,944	860	1,095	1,060	498	675	836	719
U.S.S.R.	31 December	23,118	26,700	....	....	12,400	13,600	8,700	7,200
Former boundaries ..	31 December	....	....	....	....	....	....	....	8,600
Present boundaries ..	31 December	....	....	....	....	....	....	....	....
United States ..	31 December	43,637	54,353	60,607	73,881	83,741	59,331	61,301	56,901
Canada ..	1 June	3,760	6,002	6,081	7,125	8,148	7,741	6,026	4,910

COUNTRY	DATE, ENUMERATION	1934-38	1940 (Thou- sand head)	1941 (Thou- sand head)	1942	1943	1944	1945	1946
Mexico.....	May	¹⁴ 3,698	5,117	....	....	....	...	...	...
Cuba.....		¹⁹⁵²	857	....	....	...	...	669	...
Argentina.....	30 June	¹⁷ 3,674	¹⁸ 3,381	¹⁴ 4,980	5,707	¹⁸ 6,800	¹⁸ 8,800	8,010	¹⁸ 5,000
Brazil.....	September	¹⁶ 24,041	21,687	....	¹⁸ 25,000	....	...	24,344	...
Uruguay....	May	¹⁹ 346	¹⁹ 346	....	....	¹¹ 261	...	...	...
Chile.....	9 April	¹⁸ 572	¹⁸ 572	361	401	....	452	...	...
China Proper	31 December	¹⁸ 65,838	¹⁸ 62,639	¹⁸ 37,740	¹⁸ 35,826	¹⁸ 32,971	...	...	48,549
Japan		¹⁸ 1,077	¹⁸ 1,140	667	501	391	310	250	88
India & Pakistan		....	2,800	....	....	....	...	...	4,032
Union of S. Africa	July-August	975	¹⁸ 466	...	....	1,174	...	...	...
Australia..	31 March	1,160	¹⁷ 1,455	¹⁷ 1,707	¹⁷ 1,477	1,563	1,747	1,631	1,426
New Zealand	31 January	758	706	762	681	605	573	594	549

Source: Based on data from International Institute of Agriculture and from official reports from governments.

¹ Year 1934.

² Unofficial estimate

³ The figure is not strictly comparable with the preceding years because of change in method of enumeration

⁴ January of the following year.

⁵ Year 1939

⁶ Rural districts only

⁷ 20 June 1939

⁸ 15 September enumeration

⁹ Adjusted for postwar boundaries.

¹⁰ Average of 2 years, 1934 and 1938.

¹¹ Enumeration made during second half of year at different dates in the various Länder

¹² 15 October enumeration.

¹³ Average of 3 years, 1936 through 1938.

Note: New Zealand numbers have been adjusted to postwar boundaries.

¹⁴ Year 1939. Includes 2,500 hogs in the Dodecanese.

¹⁵ On farms.

¹⁶ Average of 2 years, 1937 and 1938.

¹⁷ Year 1938.

¹⁸ Average of 3 years 1935, 1937, and 1938.

¹⁹ Year 1937.

²⁰ Incomplete data.

²¹ Year 1936.

²² Average of 2 years; 1934 and 1935.

²³ Year 1935.

²⁴ Figures relate to "Free China."

²⁵ European-owned.

²⁶ For some states, 31 December of preceding year.

TABLE 68. LIVESTOCK: NUMBER AND FARM VALUE, UNITED STATES, JAN. 1, AVERAGE 1943-52, ANNUAL 1953 AND 1954

CLASS OF LIVESTOCK AND POULTRY	NUMBER ON FARMS AND RANCHES			FARM VALUE					
				PER HEAD ²			TOTAL		
	Average 1943-52	1953	1954 ¹	Average 1943-52	1953	1954 ¹	Average 1943-52	1953	1954 ¹
	Thousands	Thousands	Thousands	Dollars	Dollars	Dollars	1,000 dollars	1,000 dollars	1,000 dollars
Cattle	81,673	93,637	94,677	109.00	128.00	92.40	8,919,864	11,998,139	8,746,058
Cows and heifers 2 yrs. old and over kept for milk	25,440	24,094	24,735	156.00	202.00	146.00	3,894,924	4,862,803	3,614,427
Hogs	63,124	54,294	48,179	29.20	26.00	36.60	1,796,030	1,409,988	1,763,714
All sheep							555,199	507,320	431,963
Stock sheep							478,962	437,002	372,958
Horses							431,893	179,395	167,568
Mules							333,207	114,426	98,402
Total ³							17,036,195	14,209,268	11,207,705
Chickens							14	606,935	629,024
Turkeys							68	32,687	33,594
Total ⁴							12,726,307	14,848,890	11,870,323

¹ Preliminary.

² Based on reporters' estimates of average price per head in their localities.

³ Includes cattle, hogs, all sheep, horses, and mules.

⁴ Includes cattle, hogs, all sheep, horses, mules, chickens, and turkeys.

Agricultural Marketing Service, U.S.D.A.

TABLE 69. LIVESTOCK and LIVESTOCK PRODUCTS: PRODUCTION AND VALUE, UNITED STATES, AVERAGE 1942-51, ANNUAL 1951-53

PRODUCT	PRODUCTION ¹				VALUE OF PRODUCTION			
	Average 1942-51	1951	1952	1953 ²	Average 1942-51	1951	1952	1953 ²
	1,000 pounds	1,000 pounds	1,000 pounds	1,000 pounds	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Cattle and calves ³	19,513,487	21,889,259	23,524,580	25,561,307	3,431,538	6,342,244	5,709,225	4,114,920
Sheep and lambs ³	1,694,303	1,350,892	1,407,123	1,434,297	265,980	366,310	289,972	243,650
Eggs								
Horses ⁴								
Mules ⁴								
	Thousands	Thousands	Thousands	Thousands				
Eggs	55,831,000	59,265,000	60,985,000	61,704,000	1,845,797	2,354,016	2,108,592	2,444,288
Horses ⁴	392	184	169	119	25,626	7,285	6,669	4,905
Mules ⁴	94	39	29	22	9,305	1,966	1,273	1,018

¹ For cattle, sheep, and hogs, the quantity of net production is the liveweight actually produced during the year, adjustments having been made for animals shipped in and changes in inventory.

² Preliminary.

³ Including commercial broiler production.

⁴ Coming 4 years of age

Agricultural Marketing Service, U.S.D.A.

TABLE 70. HOGS: NUMBER ON FARMS, VALUE AND CLASSES UNITED STATES, JAN. 1, 1940-54 AND NUMBER 6 MONTHS OLD AND OVER ON FARMS, UNITED STATES, JUNE 1, 1940-54

YEAR	HOGS ON FARMS, JAN. 1						HOGS 6 MONTHS OLD AND OVER JUNE 1
	TOTAL NUMBER	FARM VALUE		UNDER 6 MONTHS	6 MONTHS OLD AND OVER		
		Per head	Total		Sows and gilts	Other	
	Thousands	Dollars	1,000 dollars	Thousands	Thousands	Thousands	Thousands
1940 ¹	34,637	.....	.....	.....	.....	.....	.....
1940.....	61,165	7.78	475,866	30,044	9,413	21,708	27,168
1941.....	54,353	8.34	453,081	26,328	8,565	19,460	24,647
1942.....	60,607	15.60	944,907	31,090	10,679	18,818	28,841
1943.....	73,881	22.50	1,662,381	38,401	13,334	22,146	36,257
1944.....	83,747	17.50	1,466,666	42,337	10,825	30,579	34,500
1945 ¹	46,735	.....	.....	.....	.....	.....	.....
1945.....	59,373	20.60	1,224,553	27,221	9,229	22,923	25,566
1946.....	61,306	24.00	1,468,450	30,049	9,390	21,857	22,699
1947.....	56,810	36.00	2,046,471	26,754	9,522	20,534	23,581
1948.....	54,590	42.50	2,339,776	26,999	8,681	18,910	22,955
1949.....	56,257	38.30	2,154,480	28,925	9,807	17,525	21,950
1950 ¹	27,255	.....	.....	.....	.....	.....	.....
1950.....	58,852	27.20	1,597,900	31,650	10,244	16,958	22,419
1951.....	62,852	33.30	2,094,238	34,703	10,610	17,539	24,285
1952.....	63,582	30.00	1,905,390	35,112	9,637	18,833	22,565
1953.....	54,294	26.00	1,409,988	30,612	8,263	15,419	18,341
1954 ²	48,179	36.60	1,763,714	28,043	8,731	11,405	17,119

¹ Italic figures are from the census. Census dates are Apr. 1, 1940; Jan. 1, 1945; Apr. 1, 1950 1940 and 1950 exclude spring-born pigs.

² Preliminary.

Agricultural Marketing Service, U.S.D.A.

TABLE 71. PIG CROP: NUMBER OF SOWS FARROWING AND PIGS SAVED, UNITED STATES, 1940-54

YEAR	PIG CROP					YEAR	PIG CROP				
	SOWS FARROWING		PIGS SAVED ¹				SOWS FARROWING		PIGS SAVED ¹		
	Spring	Fall	Spring	Fall	Total		Spring	Fall	Spring	Fall	Total
	Thou- sands	Thou- sands	Thou- sands	Thou- sands	Thou- sands		Thou- sands	Thou- sands	Thou- sands	Thou- sands	Thou- sands
1940...	8,247	4,763	49,584	30,282	79,866	1943...	7,833	5,070	50,468	33,358	83,826
1941...	7,760	5,335	49,368	35,584	84,952	1949	8,820	5,568	56,969	36,275	93,244
1942...	9,684	6,840	61,073	43,810	104,903	1950	9,174	5,923	57,935	37,404	97,339
1943...	12,174	7,565	74,223	47,584	121,807	1951	9,591	6,032	62,007	39,804	101,811
1944...	9,246	4,882	55,754	30,905	86,659	1952	8,490	5,257	56,270	34,961	91,231
1945...	8,302	5,429	52,216	34,611	86,827	1953	7,300	4,762	49,703	31,882	81,585
1946...	8,077	4,704	52,191	30,503	82,694	1954 ²	8,128	..	54,066	..	..
1947...	8,548	4,866	52,199	31,070	83,269						

¹ Pigs raised to weaning age or living on June 1 or Dec. 1 respectively.

² Preliminary.

Agricultural Marketing Service, U.S.D.A.

TABLE 72. HOGS: PRODUCTION, DISPOSITION, CASH RECEIPTS, AND GROSS INCOME, UNITED STATES, 1930-46

YEAR	MARKET- INGS ¹	SHIPPED IN FOR FEEDING AND BREED- ING ²	FARM SLAUGH- TER	QUANTITY PRODUCED (LIVE WEIGHT) ³	VALUE OF PRODUC- TION ⁴	CASH RE- CEIPTS FROM SALES OF HOGS, PORK, AND LARD ⁵	GROSS IN- COME ⁶	VALUE OF HOGS SLAUGH- TERED FOR HOME CON- SUMPTION	COST OF HOGS SHIPPED IN FOR FEEDING AND BREEDING	ANNUAL AVERAGE PRICE PER 100 POUNDS RECEIVED BY FARMERS
	1,000 head	1,000 head	1,000 head	1,000 pounds	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	Dollars
1930..	53,796	477	13,540	8	1,340,302	0	1,368,718	8	5,500	8.84
1931..	55,972	1,366	14,338	4	966,570	8	949,769	1	10,944	5.73
1932..	55,844	477	15,580	4	561,989	2	557,181	9	2,623	3.34
1933 ⁷	65,661	1,454	15,244	3	602,150	6	631,490	4	7,741	3.53
1934..	55,750	1,237	15,110	0	520,147	9	645,692	3	8,044	4.14
1935..	32,749	481	13,348	6	906,973	4	889,995	1	5,293	8.65
1936..	44,809	639	14,295	6	1,196,314	6	1,234,161	5	6,903	9.37
1937..	40,665	367	13,333	1	1,176,449	5	1,160,907	2	4,007	9.50
1938..	46,089	516	13,325	3	1,105,438	7	1,065,179	2	4,724	7.74
1939..	52,906	637	13,980	9	1,066,050	5	980,706	11	4,892	6.23
1940..	64,262	607	14,155	4	919,927	8	984,165	17	4,233	5.39
1941..	57,695	741	12,789	5	1,576,855	4	1,518,199	15	7,621	9.09
1942..	67,423	600	12,533	3	2,734,255	5	2,507,430	5	8,642	13.00
1943..	83,187	771	14,016	5	3,466,520	6	3,302,012	17	11,645	13.70
1944..	86,331	658	13,551	3	2,674,178	5	3,133,891	15	9,397	13.10
1945...	60,959	464	13,631	6	2,672,024	2	2,673,956	14	7,144	14.00
1946 ⁸ ...	64,599	464	13,850	-1	3,330,297	9	3,459,978	19	8,791	17.50

¹ Excludes interfarm sales.

² Includes hogs shipped in from other States and from central markets but excludes intrastate shipments.

³ Adjustments were made for hogs shipped in and changes in inventory.

⁴ No adjustments made for cost of hogs shipped in and changes in inventory values.

⁵ Value of hogs slaughtered for home consumption.

⁶ Includes Government purchases.

⁷ Preliminary.

⁸ Bureau of Agricultural Economics Data for 1924-29 in *Agricultural Statistics, 1942*, table 514.

⁹ Cash income from sales of hogs, pork, and lard" plus

**TABLE 73. HOGS: AVERAGE LIVE WEIGHT SLAUGHTERED UNDER
FEDERAL INSPECTION UNITED STATES, BY MONTHS, 1937-41
AVERAGE, 1942-48**

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
1937-41 av.	230.5	229.7	229.3	229.4	232.8	244.5	254.8	246.0	234.4	226.4	227.0	231.7	233.5
1942													
1943													
1944													
1945													
1946													
1947													
1948													

Production and Marketing Administration.

TABLE 74. HOGS: ANNUAL SLAUGHTER, UNITED STATES, 1930-46

YEAR	FEDERALLY INSPECTED	NOT FEDERALLY INSPECTED		TOTAL	YEAR	FEDERALLY INSPECTED	NOT FEDERALLY INSPECTED		TOTAL
		Other wholesale, and retail	Farm				Other wholesale, and retail	Farm	
	Thousands	Thousands	Thousands	Thousands		Thousands	Thousands	Thousands	Thousands
1930.....	44,266	9,466	13,540	67,272	1939.....	41,368	11,213	13,980	66,561
1931.....	44,772	10,123	14,338	69,233	1940.....	50,398	13,057	14,155	77,610
1932.....	45,245	10,600	15,580	71,425	1941.....	46,520	12,088	12,789	71,397
1933.....	47,226	10,800	15,244	73,270	1942.....	53,897	12,117	12,533	78,547
1934.....	43,876	9,774	15,110	68,760	1943.....	65,431	17,779	14,016	95,226
1935.....	26,057	6,606	13,348	46,011	1944.....	69,017	15,500	13,551	98,068
1936.....	36,055	8,380	14,295	58,730	1945.....	40,960	17,300	13,631	71,891
1937.....	31,642	8,740	13,333	53,715	1946 *	44,394	18,000	13,850	76,244
1938.....	36,186	9,416	13,325	58,927					

* Does not include the 6,410,866 pigs and sows purchased for Government account under the emergency hog production control program during Aug. 18-Oct. 6, 1933.

* Includes slaughter in war-duration or "Fulmer" plants, representing an increase in the number of federally inspected slaughter plants.

* Data obtained from reports of slaughterers.

* Preliminary.

Bureau of Agricultural Economics.

TABLE 75. PARTIAL COMPOSITION OF SOME HOO FEEDS (AIR-DRY BASIS), NATIONAL RESEARCH COUNCIL, 1953

Feedstuff	ENERGY AND PROTEIN		INORGANIC NUTRIENTS			VITAMINS PER POUND FEEDSTUFF				
	Total digestible nutrients	Gross protein	Calcium	Phosphorus	Carotene	Thiamine	Riboflavin	Niacin	Pantothenic Acid	Choline
	%	%	%	%	Mg.	Mg.	Mg.	Mg.	Mg.	Mg.
Grains and other carbohydrate										
Barley, erect Pacific Coast	72	12.7	.09	.47	..	1.7	.8	24.1	3.7	530
Barley, Pacific Coast	70	9.7	.06	.41	2.0	1.8	.6	20.0	3.3	425
Barley, Pacific Coast	78	8.6	.02	.27	..	1.8	.5	10.2	2.7	220
Corn, No. 2, yellow	65	12.0	.09	.43	..	2.9	.6	8.2	6.4	480
Oats	75	12.6	.01	.33	..	2.0	.7	7.1	5.2	..
Rye	78	11.3	.03	.30	..	1.7	.6	21.3	5.0	400
Sorghum, grain	80	13.5	.05	.37	..	2.2	.5	26.6	6.0	100
Wheat	88	7.4	.06	.22	..	..	..	..	..	480
Protein concentrates										
Barley meal, sweet	82	8.2	.06	.22	..	..	..	..	..	..
Barley meal, white	80	11.2	.05	.66	4.1	3.8	1.0	22.6	3.5	..
Hominy feed, yellow	71	12.8	.08	1.36	..	10.3	1.4	163.0	17.9	572
Rice bran	48	12.4	.03	1.80	..	9.1	1.0	235.0	5.5	..
Rice polish	74	16.7	.74	.08	..	1.3	1.0	7.8	10.5	390
Rye middlings	58	3.1	.09	.90	1.4	4.4	1.1	21.3	7.1	600
Soybean meal	65	17.6	.06	.47	..	7.5	1.1	56.1	13.2	648
Wheat standard middlings	73	18.3	.14	1.30	..	9.7	1.2	126.5	6.2	..
Wheat red dog	57	16.4	.14	1.30	..	3.6	1.2	..	..	..
Wheat bran	72	41.0	.23	1.18	..	5.0	2.5	13.0	6.4	1525
Protein supplements (plant)										
Contaminated meal (51%)	68	35.4	.36	.86	..	3.5	1.5	16.8	8.0	650
Linseed meal (35%)	62	41.6	.10	.50	..	2.6	1.6	96.6	24.7	1025
Peas meal (41%)	79	42.0	.24	.63	..	4.1	1.7	11.4	10.1	1330
Soybean meal (exp. 43%)	76	46.0	.35	.68	..	6.1	1.7	58.0	10.6	1620
Soybean meal (exp. 43%)	77	28.0	.35	1.32	..	3.2	1.0	213.6	49.1	..
Diastase soluble, dried	71	46.8	.11	1.50	..	43.0	13.0	..	13.5	1050
Yeast, brewers, dried	77	32.4	1.35	.04	..	1.7	13.7	2.8	12.7	..
Protein supplements (animal)										
Buttermilk, dried	65	62.2	5.00	2.40	..	..	2.4	25.0	1.3	1280
Fishmeal, menhaden	68	67.2	4.21	2.56	..	.2	2.5	26.0	1.3	750
Fishmeal, sardine	67	50.6	9.70	4.20	..	..	2.1	24.8	2.3	..
Meat and bone scrap (50%)	72	60.9	6.30	3.50	..	..	2.5	23.7	16.0	745
Meat scrap (60%)	86	34.7	1.27	.10	..	1.5	10.0	5.7	10.7	1047
Skimmed milk, dried	71	60.6	6.11	3.01	..	1.1	1.2	19.2	1.2	1000
Skimmed milk (60%)	83	12.2	.91	.75	..	1.8	13.0	5.1	22.4	..
Whey, dried										
Miscellaneous										
Alfalfa meal, sun cured (17%)	30	17.6	1.50	.30	20.0	1.1	5.0	16.1	12.7	600
Alfalfa meal, sun cured (20%)	34	20.9	1.42	.25	20.0	1.8	7.0	24.0	17.4	590
Alfalfa meal, dehydrated (17%)	53	17.8	1.70	.28	36.0	1.5	7.3	18.3	..	..
Alfalfa meal, dehydrated (17%)	..	17.2	29.30	13.60	..	1.0	..	2.0	..	..
Bone meal, special bleached	..	11.1	28.50	13.50	..	..	..	..	..	..

Note: The data on the average compositions of feedstuffs are taken from the figures supplied by the Committee on Feed Composition of the National Research Council, School of Agriculture, University of California, Davis, California, U.S.A.

TABLE 76. DAILY NUTRIENT REQUIREMENTS FOR SWINE, NATIONAL RESEARCH COUNCIL, 1953

NUTRIENT	DESCRIPTION OF PIGS									
	MARKET STOCK						BREEDING STOCK			
							Pregnant females and breeding boars		Lactating females	
							Young stock	Adults	Gilts	Adults
Liveweight, lb.....	25	50	100	150	200	250	300	500	350	450
Expected daily gain, lb.....	0.8	1.2	1.6	1.8	1.8	1.8	0.75	0.5	...	...
Total feed (air dry), lb.....	2.0	3.2	5.3	6.8	7.5	8.3	6.0	7.5	11.0	12.5
Total digestible nutrients (75% TDN), lb.....	1.6 ¹	2.4	4.0	5.1	5.6	6.2	4.5	5.6	8.3	9.4
Crude protein, lb.....	0.36	0.51	0.74	0.88	0.90	1.00	0.90	1.05	1.65	1.75
Inorganic nutrients										
Calcium, gm.....	7.3	9.4	15.6	17.0	18.7	20.7	16.3	20.4	30.0	34.0
Phosphorus, gm.....	5.4	66.5	10.8	10.2	11.2	12.4	10.9	13.6	20.0	22.7
Salt (NaCl), gm.....	4.5	7.3	12.0	15.4	17.0	18.8	13.6	17.0	25.0	23.4
Vitamins:										
Carotene, mg.....	0.5	1.0	2.0	3.0	4.0	5.0	15.0	18.7	27.5	31.2
Vitamin D, I.U.....	180.0	288.0	477.0	612.0	675.0	747.0	540.0	675.0	990.0	1,125.0
Thiamine, mg.....	1.0	1.6	2.6	3.4	3.8	4.2	3.0	3.8	5.5	6.2
Riboflavin, gm.....	2.4	3.2	5.3	6.8	7.5	8.3	7.2	9.0	13.2	15.0
Niacin, mg.....	14.0	19.2	26.5	34.0	37.5	41.5	30.0	37.5	55.0	62.5
Pantothenic acid, mg.....	10.0	16.0	23.8	30.6	33.8	37.4	27.0	33.8	49.5	56.2
Pyridoxine, mg.....	1.2	1.9	...	...	...	...	...	...	...	...
Choline, mg.....	800.0	...	...	...	...	...	...	...	...	...
Vitamin B ₁₂ , mcg.....	20.0	16.0	26.5	...	...	...	...	...	...	...

¹ For young pigs a high-energy diet (80% TDN) is recommended.

TABLE 77. NUTRIENT REQUIREMENTS FOR SWINE IN PERCENTAGE OR AMOUNT PER POUND OF TOTAL RATION, NATIONAL RESEARCH COUNCIL, 1953

	DESCRIPTION OF PIGS									
	MARKET STOCK						BREEDING STOCK			
							Pregnant females and breeding boars		Lactating females	
							Young stock	Adults	Gilts	Adults
Liveweight, lb.....	25	50	100	150	200	250	300	500	350	450
Expected daily gain, lb.....	0.8	1.2	1.6	1.8	1.8	1.8	0.75	0.5	...	...
Total digestible nutrients, lb.....	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Crude protein, %.....	18.0	16.0	14.0	13.0	12.0	12.0	15.0	14.0	15.0	14.0
Inorganic nutrients:										
Calcium, %.....	0.8	0.65	0.65	0.55	0.55	0.55	0.6	0.6	0.6	0.6
Phosphorus, %.....	0.6	0.45	0.45	0.33	0.33	0.33	0.4	0.4	0.4	0.4
Salt (NaCl) %.....	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Vitamins:										
Carotene, mg ..	0.25	0.31	0.38	0.44	0.53	0.60	2.5	2.5	2.5	2.5
Vitamin D, I.U..	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
Thiamine, mg ..	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Riboflavin, mg ..	1.2	1.0	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
Niacin, mg ..	8.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Pantothenic acid, mg ..	5.0	5.0	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Pyridoxine, mg.....	0.6	0.6	...	...	...	...	...	...	...	...
Choline, mg ..	400.0	...	...	...	...	...	...	...	...	...
Vitamin B ₁₂ , mcg ..	7.0	5.0	5.0	...	...	...	...	...	...	...

TABLE 78. CLINICAL SYMPTOMS OF DIETARY DEFICIENCIES, NATIONAL RESEARCH COUNCIL, 1953

DEFICIENT NUTRIENT	SLOW OR INTER- RUPTED GROWTH	RE- DUCED AP- PETITE	POOR HAIR AND SKIN CONDI- TION	LAME- NESS AND STIFF- NESS	DIS- EASE	IM- PAIRED REPRO- DUCTION	DEAD OR WEAR- ING OFF BEFORE AT MATURE AGE	WEAK- NESS OR STRAU- GHT- NESS	ANEMIA	OTHER EFFECTS
Energy	•	••	•	•	•••	•	••	••	•••	Reduced fatness in proportion to body weight. Poor feed efficiency.
Protein Level	•	•	•	•	••	••••	••	••	••	Loss of hair; scaly, dandruff-like dermatitis, especially of feet and tail.
Essential amino acids	•	•	•	•	••	••••	••	••	••	Severe cases may show reduced serum calcium and tetany.
Fats	•	•	•	•	•••	•	•	•	•••	Reduced inorganic blood phosphorus.
Calcium	•	•	•	•	••	••••	••	••	••	Depraved appetite.
Phosphorus	•	•	•	•	••	••••	••	••	••	Birth of hairless pigs, gonorrhea.
Sodium (as common salt)	•	•	•	•	••	••	••	••	•	A disease of young pigs: high mortality; susceptibility to parasite invasion; thrush.
Iodine	•	•	•	•	••	••	••	••	•	Lack of rigidity of leg joints, hocks excessively flexed; forelegs crooked; use of forelegs impaired.
Iron	•	•	•	•	••	•	••	••	•••	Incoordination of movement, head tilted, extreme weakness of back, brown greasy exudate, later—night blindness and contraction of optic nerve.
Copper	•	•	•	•	••	•	••	••	••	Rickets, enlarged joints, weak bones.
Vitamin A	•	•	•	•	••	•	••	••	••	Slow pulse, low body temperature, flabby heart.
Vitamin B	••	•	•	•	••	•	••	••	••	Crooked legs.
Thiamine	•	•	•	•	••	•	••	••	••	Moderate slowing of growth, occasional vomiting, foul-smelling feces, pig pellagra.
Riboflavin	•	•	•	•	••	•	••	••	••	Incoordinated, wobbly gait (goose-stepping).
Niacin	•	•	•	•	••	•	••	••	•	Epileptic-like fits, slowing of growth after first convulsion.
Pantoic acid	•	•	•	•	••	•	••	••	••	Lack of co-ordination. Improper rigidity in joints, fatty liver, renal glomerular occlusion, and tubular epithelial necrosis.
Pyridoxine	•	•	•	•	••	•	••	••	••	Hyperirritability, postpartum inco-ordination, voice failure, pain in rear quarters.
Choline	•	•	•	•	••	•	••	••	•	
Vitamin B ₁₂	•	•	•	•	••	•	••	••	•	

In general, the applicable symptoms marked * for a given nutrient deficiency should be observed in the sick animal before a positive diagnosis is made that deficiency of that nutrient in fact exists or is the cause of the ill health of the pig.

Index

- Abortion, 495-496
Acquired characteristics, 337
Adjusting hog production to
market demand, 455-457
Advantages of
central hog house, 376-377
hogs, 11-12
limited feeding on pasture,
231, 456
locating in a hog-growing dis-
trict, 19
movable hog house, 387-388
purebreds, 338-340
Age and weight, 32-33
boar to use, 118-119
breeding stock, 97
sow to breed, 117-118, 148
Alfalfa, 286-290, 316-317
chopped, 286
dehydrated, 286
hay, 287-289
meal comparisons, 289
and meal quality, 287
leaf meal, 286
meal, 133-135, 209-210, 286-
290
Alfalfa—(Continued)
composition, 287-288
feed saved, 289
how much to feed, 290
method of feeding to sows,
133-135
stem meal, 286
Anemia, 181-183
Animal protein feeds and fac-
tors, 199, 274-286
Antibiotics, 297
Appendix tables, 509-518
Areas of hog raising, 4-7
Arranging of hog houses and
lots, 23-24
Artichoke, Jerusalem, 334
Artificial insemination, 120
Associations, breeders', 351, 354-
357
Auction or private sale, 108
Baby pig diseases, 162-163
Back crossing, 336-337
Bacon type, 38-42
Balanced ration, 190

- Barley, 130, 250-252
 compared with corn, 251
 for sows, 130
 hull-less, 251
 scabbed, 251-252
- Barrows market, 26-43
- Basal feeds
 characteristics, 233-234
 comparative value, 237
- Beans, 273
- Benzene hexachloride, 506
- Berkshires, 79-82
- Blood meal, 279
- Bluegrass, 321
- Boars
 age effect on feeding and management, 115
 age
 first mating, 117-118, 149
 to use, 118-119
 clipping tusches, 166-167
 crossbred, 344-345
 different ages, 144
 exercise, 116
 feeding and management, 144
 feeds to use, 116, 144
 amount, 116, 145
 housing, 143
 qualifying, 100
 range, 143-144
 ranting, 117
 rations, 144
 separation from sows, 117
 services, number of, 119
 slow breeders, 124
 watering, 145
- Bran, 259
- Breed
 choosing, 51
 key to determining, 47-48
 others in U. S., 92-93
- Breed—(Continued)
 publications, 93
 type, 44
- Breeder, 336
- Breeders' associations, 351, 354-357
- Breeding
 chapter 16, 336-358
 crate, 420, 423
 combination, 420
 herd, 95-146
 rations, 114
 sows that have farrowed, 120
 summer, 126
 winter, 126
 records, 125
 seasons, 110
 sows to be marketed, 444-445
 stock selection, 95-107
 terms, 336-337
 time of, 121-122
- Breeds, 44-94
 Berkshire, 79-82
 Chester White, 64-68
 choosing, 51
 Duroc, 52-58
 Hampshire, 71-75
 Hereford, 87-90
 new, 90-92
 OIC, 69-70
 other, 92-83
 Poland China, 58-64
 prolificacy, 45
 Spotted Poland China, 75-79
 Tamworth, 82-84
 types within, 48-49
 Yorkshire, 84-87
- Brewers' yeast, 215-216
- Brome grass, 289, 292, 318
- Brood sow, 147-189
- Brucellosis, abortion, 495-496

- Buckwheat, 254
middlings, 272
- Buildings and equipment, 21
chapter 18, 373-429
- Buttermilk, 281-285
condensed, 284
dried, 285
- By-products, corn, 271-272
- Calcium, 139-140
- Carbohydrates, 187, 191, 193-194
- Carcass divisions, 477
and live hog, 27-29, 42
- Cassava, 335
- Castration, 185-186
- Central hog house, 376-387
- Cheese parings or meal, 285
- Chenopodium, oil of, 502
- Chester White, 64-68
- Chlorodane, 506
- Cholera, hog, 186, 489-492
- Choline, 314
- Chufas, 335
- Chute, hog loading, 416-417
- Classification of breeds, 46-48
- Climate, 22
- Clipping tushes, 166-167
- Clover, 317-320
alsike, 320
burr, 321
crimson, 320
Ladino, 326-327
lespedeza, 320
red, 319-320
sweet, 319-320
white, 320
- Cocklebur poisoning, 231-232
- Cocoanut meal or copra, 259
- Combination hog houses, 382
breeding crate, 423
system, 16
- Commercial feeds, 298-302
- Concentrates to feed pregnant
sows, 137-138
- Concentration of ration, 199, 200
- Concrete feeding floors, 404-411
- Condition or fleshing, 35
- Confinement system, 16-17, 203-215
- Consumption, pork and lard, 11
- Control of diseases and parasites,
487-509
- Co-operative shipping and asso-
ciations, 434-435
- Corn, 238-245
alone and with tankage, 244
by-products, 271-272
germ meal or cake meal,
271-272
as a supplement, 272
calico, 241
and cob meal, 130, 240
comparisons, 236-237, 242-243
deficiencies, 238-239
dent, 240
ear, 239
from well or poorly managed
land, 233-234
getting the most out of, 245-246
grades, 243-244
grinding, 240
hard and soft, 241-242
high protein, 241
hogging down, 328-332
hybrid, 241-242
moldy, 243
per acre yield with soybeans,
332-333
pop, 241
preparation, 240-241
red, 241

Corn—(Continued)

shelled, 239-240

soaking, 240

soft, feeding, 240-241, 243

with soybeans, 332-333

standing, supplementing, 331-332

supplementing, 244-245

sweet, 241

waxy, 241

white, 241

white capped, 241

yellow, 209, 241

Cottonseed meal, 267-269

compared with tankage, 268

death loss, 268

feeding in safety, 268-269

Cow manure, 212-213

Cowpeas, 273-274, 323

Crates, 420-426

Creep, pig, 180

Criss crossing, 337

Crops

choice for swine forage, 225-226

harvesting with hogs, 328-335

Cross-bred, 342-346

advantages, 342-344

boars, 344-345

sows, 344

Cross breeding, 342-346

Crosses, three way, 345

Cross lines, 337

Crude fiber content ration, 191, 199-200, 247-248

Crude protein, 190

Cryptorchid or ridgling, 347-348

Culling sows, 100, 446

Cull peas, 273

Cuts of pork, 476-480

Cutting and curing pork, 476-481

Daily gains, 197

Dairy by-products, 281-285

Death losses, 155-156, 449

Diarrhea, 496-497

Dipping vat, 418

Direct packer buying, 435-437

Disadvantages of hogs, 12-13

Diseases, 142

chapter 22, 487-508

Distribution, swine and pork production, 8-11

Dockage on market, 443

Drainage, 22

Drenching, 507

Dressing percentage, 35, 472-473

Dried distillers

grains, 256

solubles, 273

Dry-lot raising of hogs, 190-319

Duroc, 52-58

Dwarf Essex Rape, 318-319, 321-322

Ear marking, 165-166

Eggs infertile, 216, 285-286

Elimination of concentrates of forage, 231

Emmer or speltz, 254

Equipment, 373-429

farrowing house, 166

swine raising, 396-429

Erysipelas, 497-498

Essentials of sanitation, 161-162

Ether extract, 190

Exercising pens for pigs, for sows, 163-164

External parasites, 504-507

- Fall
 breeding season, 110-125
 farrowing season, 167
- Fall pigs
 advantages, 167
 cost of gains compared, 168
 disadvantages, 168
 feed, labor costs compared, 168
 full feeding, 456
 McLean Co. system for, 161
 pastures, 174
 rations, 174
 shelter, 173
- Family, 337
- Farm accounts, 459-465
 adaptation, 453-454
 business functions of hogs in,
 17
 comparisons, 466
 enterprises, 458-459
 income, 8, 466
 layout, 454
 limiting factors in producing,
 454-455
 location, 19
 raising hogs, 7-8
 records, 459-465
 size, 17-18
 value for hog raising, 14
- Farrowing stall, 152, 153
- Farrowing house, 152
 bedding, 153
 guard rail or fender, 153
 pen floor, sloping, 153
 records, 165
 reports, 99
 temperature, 154
- Farrowing time, 147-165
 attention, 147
 care of pigs at, 164
 disease control during, 161
- Farrowing time—(Continued)
 indications of, 163
 labor involved, 147
 management during, 162
 records, 165
- Fat production, 194
- Federal market classes and
 grades, 439-443
- Feed
 allowance on pasture, 230-231
 amount consumed, 196
 budgets, 466-468
 buying, 301
 comparison based on composition,
 301-302
 grinding, 236
 labor and other costs compared,
 162, 465-466
 laws, 300
 lost from pig losses, 158
 preparation for bred sows, 141
 requirements, 467-468, 517
- Feeder and stocker pigs, 431-432
- Feeding
 creep, 180
 dry, 138
 floors, 403-411
 on forage, without protein
 supplement, 224-225
 garbage, 216-218
 grain alone, 129
 hand, 136
 indoors, 310
 methods, 135, 201
 orphan pigs, 186
 plan efficiency, 201
 requirements for swine, 467-
 468, 517
 standards not widely used for
 swine, 195
 wet, 138

Feeds

factory mixed vs. home mixed,
299-300

influencing water consumption, 412

preparation, 235-236

Fences and fencing, 330, 426-428

Field peas, 211, 273-274, 321-322
hogging off, 334

Fish

in combination, 282

meal, 209, 279-280

oils, 210

solubles, condensed, 281

Fitting for shows, 359-372

Flax seed, 211

Fleshing, 35

Flushing, 111

Fly protection, 486

Forage

adapted to South, 325

advantages, 221-222

alfalfa, 316-317

alsike clover, 320

blue grass, 321

burr clover, 321

comparisons, 227-229

cowpeas, 323

crimson clover, 320

essentials to be good, 229-230
general, 326-327

Ladino clover, 320

lespedeza or Japan clover, 320

oats, 321-322

peanuts, 324

rape, 318-319, 321-322

red clover, 317-318

rye, 322-323

saves supplements, 224

sorghum, 324

soybeans, 323

Forage—(Continued)

sudan grass, 322

sweet clover, 319-320

timothy, 321

velvet beans, 324

vetch, 324

white clover, 320

Form, 33-34

Free-will watering, 413

Functions, hogs in farm business,
17

Gains, 231

Galton's law, 337

Garbage feeding, 216-218

General appearance, 33-35

Gestation period, 121

Gluten meal, 271

Grade swine, 341-342

Grading up, 341-342

Grains, cereal, 233-254

Grain sorghums, 253-254

Grinding, 235-236

Growth of hog raising in U. S.,
3-4

Guard rail, 153

Half-monitor house, 378-379

Hampshires, 71-75

Hand feeding, 136

Hand hurdle, 419-420, 422

Harvesting crops, hogs, 328-335

Healthfulness, 22

Herd boar, age, 96, 115-120, 113-
146, 349-350

Hereford, 87-90

Hernia, 348

Hog

buildings, 373-396

Hog—(Continued)

cholera, 489-491
 corn price ratio, 446-448
 crates, 420-426
 cycles, 443-444
 dead, 442
 dipping vat, 419-420
 equipment, 396-429
 on farms in U. S., 7-8
 feeding floors, 405-411
 fences, 426-428
 "flu," 493
 functions in farm business, 17
 hand hurdle, 419-420, 422
harvesting of crops, 328-334
 houses, 373-396
 need for, 373
 spraying, 487
 housing, 373-396
 loading chute, 415-416
 mangy, 504-506
 marketed monthly and Chicago market price, 151
 marketing, 430-451
 markets, 430
 number and value, 513-514
 portable fences, 330
 prices, 445-446
 production, 431, 514
 profits and losses, 448
 protection needed, 375
 raising, 3-14, 15-18
 general plan systems, 16-17
 farms and ranches, 7-8
 roughs, 442
 shades, 420-421
 seasonal variations in prices, 444
 shipping, 448-450
 slaughtering, 470-486
 trough, 411-416

Hog—(Continued)

waterers, 412-415
 yields of different types, 27-29

Hogging-down

corn, 328-332
 grain crops, 333-334

Hogs

brought to this continent, 3
 soft or oily, 440
 to use for hogging down, 338

Hominy feed, 245-246**Houses**

central, 376-387
 movable or colony, 376-377, 387-388

Human and swine population, 10-11**Hulled oats, 249-250****Hybrid**

hogs, 337
 vigor, 342

Inbreeding, 336, 346**Income, cash from hogs, 8****Infertile eggs, 216, 285-286****Influenza, 493****Inheritance**

color, 346
defects, 347-348

Injured animals, 449**Inventory, 463-464****Inverted teats, 347****Iodized salt, 308****Jerusalem artichoke, 334****Judging**

bacon type, 38-42
 market hogs, 26-33
 procedure, 30-31

Judging—(Continued)

reasons, 32-33

score card, not common, 29-30

steps in, 29

Key to determining breeds, 47-48

Landrace, 90

Lard

rendering, 484-485

storing, 485

Legume hay, 133-135, 209-210, 286-290

Lime-sulfur treatment, 505

Limited feeding, pigs, 202, 456

Limiting protein concentrate, 224

Line-breeding, 336

Linseed meal

or cake meal, 265-267

in combinations, 266-267

compared with tankage, 266

as a single supplement, 266

Litter

marking, 165

size, 148

Lung worms, 499

Management

care of pigs, 164

during farrowing, 162

exercising pens, 163

fall pigs, 173-174

indications of farrowing, 163

quiet quarters, 163

Mange, 504-506

Market barrow, 26-43

score card, 32

Market

classes and grades, 437-443

Market—(Continued)

demand, adjusting hog production to, 455-457

distance from, 19-20

dockage, 443

federal market classes and grades, 439-443

grades, 437-443

Marketing

direct advantages, 435-436

methods, 432-434

trucking, 434

Marking, ear, 165

Mating system, 122-123

time of, 149

McLean Co. system, 161-162, 487

Meat

for homes, 470

meal, 276-279

smoking, 481-482

Mendel's law, 337

Middlings, 256-259

Milk by-products, 115, 281-285

Millet, 254

Milorganite, 218

Mineral matter, ash, 193

Mineral mixtures, 139-140, 303-308

Minerals, 139, 303-308

composition of pigs, 304

conditions influencing need, 305

deficiency symptoms, 305, 518

elements needed, 304-305

excesses to avoid, 308

mixture consumed, 306

mixture to feed, 306-307

sources of nutrients, 305

trace, 307

Mineral supplements, 139, 303-308

- Minnesota breeds, 90-92
 Molasses, 255
 Movable hog houses, 376-377,
 387-388
 Multiple farrowing, 151
 Mustard seed oil meal, 274
- National swine show weights,
 363
 Necrotic enteritis, "necro," 494-
 495
 Niacin, 192, 313-314
 Nicking, 337
 Nutrients, 190-191
 and pig losses, 159
 allowances, 189, 195, 516-517
 digestible, 191
 ratio, 193-194
 Nutritional diseases, 219, 488-
 489, 518
- Oats, 130-131, 246-250
 effect of fiber, 247
 fineness of grinding, 248
 hull-less and hulled, 249-250
 in rations for growing pigs,
 247-248
 meal, 250
 soaking, 248-249
 with Canadian field peas and
 rape, 321-322
- OIC, 68-70
 Oil of chenopodium for para-
 sites, 502
 Orphan pigs, 186-189
 Out-crossing, 336
- Packer buying, direct, 435-437
 Packing
 house by-products, 275-279
- Packing—(Continued)
 industry, 432-434
 plants, 434
 Pantothenic acid, 192, 314
 Parasites, 142, 145, 379, 499-507
 external, 504-506
 Parentage, 102
 Parts, live hog, 29-30
 Paralysis, 179
 Pasture, 220-232
 advantages, 221-222
 for breeding herd in fall, 115,
 171
 for brood sows, 226
 kind used, 220-221
 plan by months, 179, 324-325
 value of acre, 226-227
 vs. dry-lot, 222-224
 Peanut meal feed, 270-271
 Peanuts, 269-270
 Pedigree, 102, 350, 352
 Pelleting supplements, 297-298
 Phenothiazine, 502
- Pig
 anemia, 181-183
 birthweight, 156
 brooder
 building, 418-419, 421
 electric, 154
 precautions, 155
 castration, 184-185
 creep, 180
 culling, 100-101
 deaths, 155-157
 dry-lot feeding, 190-219
 why efficient, 13-14
 feeder and stocker, 411-442
 following fattening cattle, 213-
 214
 governments, 442
 meals, 180

Pig—(Continued)

- pellagra, 192, 314-315
- rickets, 184, 310-311
- roasting, 442
- slaughter, 440-441
- vaccination, 186

Plan, general of hog raising, 15-16

Poland China, 58-64

Pork

- curing, 481-482
- cuts, 481
- cutting, 477-480
- division of carcass, 477
- dressed, leading states in, 431-432
- freezing, 482-484
- and lard consumption, 11
- produced economically, 13
- sausage, 482
- smoking, 481-482

Potatoes, 254-255

Prepotency, 337

Prices, 445

Private sale, 108

Production

- costs, 465-469
- testing, 97-101
- timing to marketing, 456-458

Prolificacy of breeds, 45

Protein, 194

- levels of rations for pigs, 195
- poisoning, 196
- quality, 198-199
- supplements, 260-298

Pumpkins, 335

Purebred, 44, 337-338

- breeding time, 122
- compared with scrub, 341-342
- guarantees, 352-354
- herd improvement, 350

Purebred—(Continued)

- herd record, 462
- production testing, 97-98
- record, 351-352
- selling, 450
- in U. S., 44-45

Pyridoxine, 192, 314

Raising hogs

- on dry-lot, 190-219
- general plan, 15-16
- orphan pigs, 186-189
- system, 16-17

Rape, 318-319, 321-322

Rations, *see also* various classes

- adjusting, 137
- balanced, 190
- concentration of, 199-200
- mixed, 183-184

Rays, ultraviolet, 211

Razor back, 340

Reasons, keeping hogs on farm, 17

Record

- associations, 351
- breeding, 462
- financial, 464
- keeping, 459-465
- market hog raisers, 426-463
- production, 463
- project record books, 465
- purebred herd, 462

Red clover, medium and mammoth, 317-318

References, *see* each chapter ending

Riboflavin, 192, 313

Rice, 256

Rickets, 184, 310-311

Roads, 21-22

- Round worms, 500-502
Runts, 348-349
Rye, 253
 feeding, 253
 middlings, 259

Salt, 308
Sanitation, 161-162, 487
Santonin, 502
Score card, summary, breeding
 hogs, 101
Scours in pigs, 496-498
Screenings, 255-256
Screw or kinky tail, 347
Selecting a breed, 51
 chapter 5, 95-109
Selection of the individual, 95-101
 chapter 5, 95-109
Self-feeding, 135-136, 201-202
 for swine, 396-403
Selling on grade and yield, 443
Semisolid buttermilk, 284-285
Service
 boar, 149
 meal, 289
Shade, sun, 420, 422
Shelter, 170-171
Shipping
 crates, 420-426
 preparation for, 448
 suggestions, 448-450
Show herd, 359-372
 disease prevention, 370-371
 entering at fair, 369
 feeding, managing, 367, 370
 mistakes, in ration, 367
 preparing the hair coat, 369
 segregating boars and sows,
 365-366
 Show herd—(Continued)
 shipping, 370
 showing, 370
 size, 364
 training and exercise, 368
Showing, 359-372
 advantages, 359
 ages and classes, 359-362
 barrows, 365
 boars, 364
 groups, 365
 pigs, 364
 size and selection, 364
 sows, 364-365
Silage for sows, 135
Sire selection, 349-350
 conformation, 350
 pedigree, 350
Skim milk and buttermilk, 281
Slaughtering hogs, 470-486
Slopping, 138
Soaking, 138, 240
Sodium fluoride, 502-501
Soft pork, 265, 442-443
Sorghum grain, 253, 254
Sows
 alfalfa feeding, 133
 alfalfa meal for pregnant sow,
 134
 barley, 130
 breeding to be marketed, 444-445
 brood requirements, 96
 corn and cob meal, 130
 cottonseed meal, 132
 crossbred, 344
 culling, 100-101
 different ages, 128
 exercise, 142
 farrowing, 171

Sows—(Continued)

- feeding and managing, 128, 178
 - flushing sow herd, 111
 - following cattle, 129
 - housing, 128-129
 - legume hay, 133
 - milk production, 160
 - mineral supplements, 139-141, 306-307
 - nutrient allowances, 111-112
 - paralysis, 179
 - per cent farrowing by season and month, 5 yr. av., 150
 - prices, 446
 - protein
 - levels of rations, 112
 - supplements, 131
 - qualifying, 99
 - rations
 - before breeding, 114
 - during gestation, 128
 - pregnancy, 135-137
 - range, 129
 - self-feeding, 135-136
 - separation, 128
 - silage, 135
 - soybean oil meal, 131
 - soybeans, 131
 - stock tonics, 141
 - suckling period feeding, 172, 178
 - time of mating, 149
 - total feed, 141-142
 - vitamin feeds, 141
- Soybean oil meal, 261-264
- in mixed supplements, 264
 - and tankage compared, 263
- Soybeans, 261-265
- compared with soybean oil meal, 263

Soybeans—(Continued)

- grazing alone, 323
- how to feed, 264-265
- and soft carcasses, 265
- Spotted Poland China, 75-79
- Squashes, 335
- Standard purebred guarantees, 352-354
- Stilbestrol, 219
- Suckling periods, 169-170
- Sudangrass, 322
- Sugar beets, 211
- Sunshades, 417-420
- Supplemental mixtures, 290-298
- Swelling properties of feedstuffs, 200

Swine

- associations, 351, 354-357
- breeding, 336-358
- equipment, 373-429
- erysipelas, 497-498
- feed requirements, 467-468, 517
- houses, 373-396
- influenza, 493
- parasites, 142, 145, 499-507
- pastures, 220-232
- periodicals, 93
- sanitation, 161, 486-487
- types, 45-46
- worms, 499-504
- Swine Record Associations, 351
- Swine records, 459-465
- Swirls, 347
- System
 - ear marking, 165
 - hog raising, 16-17
 - mating, 122-123
- Tamworth, 82-84
- Tankage, 275-279

- Thiamine, 192, 313
Thiouracil, 218
Thumps, 183, 501
Thyroprotein, 218-219
Timothy, 321
Total feed intake, 196
Trichinosis, 498
Trucking, 434
Tuberculosis, 491
Types, swine
 within a breed, 48-50
 chuffy, 27-29, 50
 intermediate, 27-29, 50
 large, 27-29, 50
 market hogs, 26-30
 and purpose, 26-27
 small, 27-29, 50

Ultraviolet light irradiation, 211
Urea, 274

Vaccination of pigs, 490-491
Velvet beans, 274, 324
Vitamin supplements, 308-315
 A supplements, 311-312
 D supplements, 309-311
 labeling of commercial feeds,
 300

Vitamins, 191-193
 A, B, C, D, E, others, 191-193,
 308-315
 B complex, 313-314
 B₁₂, 199, 314
Vetch, 324
Vocational agriculture swine as-
 sociation, 355-357

Water and watering, 21, 412-415
Weaning
 weights related to length of
 feeding period, 176-177
 time, 175, 180
Weighing reports, 56 day, 99
Weight to market pigs, 196-197
Wheat, 252
 bran, 259
 by-products, 256-259
 comparative value, 252
 comparative value in mix-
 tures, 258
 middlings, 258-259
Whey, 285
Worms, 499-504

Yards, fields, and fencing, 21
Yeasts, 214-216, 274
Yellow corn, 209, 241
Yorkshires, 84-87

Sows—(Continued)

- feeding and managing, 128, 178
 - flushing sow herd, 111
 - following cattle, 129
 - housing, 128-129
 - legume hay, 133
 - milk production, 160
 - mineral supplements, 139-141, 306-307
 - nutrient allowances, 111-112
 - paralysis, 179
 - per cent farrowing by season and month, 5 yr. av., 150
 - prices, 446
 - protein
 - levels of rations, 112
 - supplements, 131
 - qualifying, 99
 - rations
 - before breeding, 114
 - during gestation, 128
 - pregnancy, 135-137
 - range, 129
 - self-feeding, 135-136
 - separation, 128
 - silage, 135
 - soybean oil meal, 131
 - soybeans, 131
 - stock tonics, 141
 - suckling period feeding, 172, 178
 - time of mating, 149
 - total feed, 141-142
 - vitamin feeds, 141
- Soybean oil meal, 261-264
- in mixed supplements, 264
 - and tankage compared, 263
- Soybeans, 264-265
- compared with soybean oil meal, 263

Soybeans—(Continued)

- grazing alone, 323
 - how to feed, 264-265
 - and soft carcasses, 265
- Spotted Poland China, 75-79
- Squashes, 335
- Standard purebred guarantees, 352-354
- Stilbestrol, 219
- Suckling periods, 169-170
- Sudangrass, 322
- Sugar beets, 211
- Sunshades, 417-420
- Supplemental mixtures, 290-298
- Swelling properties of feedstuffs, 200
- Swine
- associations, 351, 354-357
 - breeding, 336-358
 - equipment, 373-429
 - erysipelas, 497-498
 - feed requirements, 467-468, 517
 - houses, 373-396
 - influenza, 493
 - parasites, 142, 145, 499-507
 - pastures, 220-232
 - periodicals, 93
 - sanitation, 161, 486-487
 - types, 45-46
 - worms, 499-504
- Swine Record Associations, 351
- Swine records, 459-465
- Swirls, 317
- System
- ear marking, 165
 - hog raising, 16-17
 - mating, 122-123
- Tamworth, 82-84
- Tankage, 275-279

- Thiamine, 192, 313
Thiouracil, 218
Thumps, 183, 501
Thyroprotein, 218-219
Timothy, 321
Total feed intake, 196
Trichinosis, 498
Trucking, 484
Tuberculosis, 491
Types, swine
 within a breed, 48-50
 chuffy, 27-29, 50
 intermediate, 27-29, 50
 large, 27-29, 50
 market hogs, 26-30
 and purpose, 26-27
 small, 27-29, 50

Ultraviolet light irradiation, 211
Urea, 274

Vaccination of pigs, 490-491
Velvet beans, 274, 324
Vitamin supplements, 308-315
 A supplements, 311-312
 D supplements, 309-311
 labeling of commercial feeds,
 300

Vitamins, 191-193
 A, B, C, D, E, others, 191-193,
 308-315
 B complex, 313-314
 B₁₂, 199, 314
Vetch, 324
Vocational agriculture swine as-
 sociation, 355-357

Water and watering, 21, 412-415
Weaning
 weights related to length of
 feeding period, 176-177
 time, 175, 180
Weighing reports, 56 day, 99
Weight to market pigs, 196-197
Wheat, 252
 bran, 259
 by-products, 256-259
 comparative value, 252
 comparative value in mix-
 tures, 258
 middlings, 258-259
Whey, 285
Worms, 499-504

Yards, fields, and fencing, 21
Yeasts, 214-216, 274
Yellow corn, 209, 241
Yorkshires, 84-87